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AZ CORP COMMISSION DOCKET CONTROL

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES, Chairman
GARY PIERCE, Commissioner
PAUL NEWMAN, Commissioner
SANDRA KENNEDY, Commissioner
BOB STUMP, Commissioner

IN THE MATTER OF THE GENERIC DOCKET FOR THE 90 DAY PRE-APPLICATION PLANS FOR POWER PLANTS FILED PURSUANT TO A.R.S. § 40-360.02.B	E-00000M-08-0170 **NOTICE OF FILING PLAN PURSUANT TO A.R.S. § 40-360.02(B)**

Hualapai Valley Solar LLC respectfully submits the attached Plan for the Hualapai Valley Solar Project pursuant to A.R.S. §40-360.02(B).

DATED this 11th day of August, 2009.

LEWIS AND ROCA LLP

By Tom Campbell
Thomas H. Campbell
Albert H. Acken
Lewis and Roca LLP
40 N. Central Avenue, #1900
Phoenix, Arizona 85004

Attorneys for Hualapai Valley Solar LLC

ORIGINAL and thirteen (13) copies of the foregoing filed this 11th day of August, 2009, with:

Arizona Corporation Commission
Docket Control
1200 W. Washington Street
Phoenix, Arizona 85007

Arizona Corporation Commission
DOCKETED
AUG 11 2009
DOCKETED BY

2081553.1

COPY of the forgoing hand delivered this 11th day of August, 2009, to:

Janice Alward, Legal Division
Arizona Corporation Commission
1200 W. Washington Street
Phoenix, Arizona 85007

COPY of the foregoing mailed this 11th day of August, 2009, to:

John Foreman, Chairman,
Arizona Power Plant and
Transmission Line Siting Committee
Office of the Attorney General
1275 W. Washington Street
Phoenix, Arizona 85007

Betty J. Griffin

PLAN
for the
HUALAPAI VALLEY SOLAR PROJECT

Submitted by Hualapai Valley Solar LLC
August 10, 2009

Pursuant to A.R.S. §40-360.02, Hualapai Valley Solar LLC ("Applicant") hereby submits its plan ("Plan") for the proposed Hualapai Valley Solar Project (the "Project").

Introduction:

Applicant is a wholly owned affiliate of Mohave Sun Power LLC. Applicant proposes to construct a nominal 340 MW concentrating solar powered electric generating facility, with associated on-site, generation intertie transmission line ("Gen-Tie Line") and on-site switchyard.

The Project is located in central Mohave County, approximately 27 miles north of Kingman, Arizona.

A.R.S. §40-360.02(B) requires a party contemplating construction of a thermal electric generating plant to file a plan with the Arizona Corporation Commission at least 90 days prior to filing an application for a Certificate of Environmental Compatibility ("CEC") for such plant. Applicant intends to file such an application for the Project in late 2009 and, therefore, files this Plan at least 90 days in advance of filing such application. This Plan covers the solar generating facility and associated Gen-Tie Line that will be constructed and owned by Applicant or its successors or assigns.

In addition, this Plan also addresses a new 500kV switchyard and a short loop in-out of the existing Mead Phoenix Project 500kV transmission line. These facilities will both be owned by Mead Phoenix Project's Participants and/or owners (collectively, "MPP") and constructed on and adjacent to the Project site in conjunction with the Project.

If it is determined that the MPP-owned switchyard and loop in-out facilities also require a CEC, this Plan shall also constitute the plan under A.R.S. § 40-360.02 prerequisite to a joint or separate application for a CEC covering such facilities.

Specific Plan Information:

The specific items of information required by A.R.S. §40-360.02(C), and the applicable responsive Plan information for the Hualapai Valley Solar Project, to the extent known, are set forth below:

With respect to the power plant:

1. "The location of any plant proposed to be constructed":

   The Project's power plant is located in central Mohave County, approximately 27 miles north of Kingman, Arizona, on a contiguous site comprising all or portions of Sections 19, 20, 21, 28, 29, 30 and 31 of Township 26 North, Range 16 West, Gila and Salt River Base and Meridian (G&SRB&M), Mohave County, Arizona.

2. "The purpose to be served by each proposed plant":

   The Project will supply renewable solar-powered electrical generation to load serving utilities.

3. "The estimated date by which the plant will be in operation":

   The Project is estimated to be in commercial operation by late 2013.

4. "The average and maximum power output measured in megawatts of each plant to be installed:

   The Project will be designed to produce up to 340 MW of gross power output from a single 340 MW steam turbine.

5. "The expected capacity factor for each proposed plant":

   The capacity factor of the Project will depend upon actual weather factors influencing the solar insolation and resulting operating profile, but is anticipated to be in the range of 38% to 43%, with generation produced primarily during peak load hours.

6. "The type of fuel to be used for each plant":

   The Project will be fueled by solar thermal energy captured in a heat transfer fluid using parabolic trough concentrators and converted to steam turbine-generated electricity.

7. "The plans for any new facilities shall include a power flow and stability analysis report showing the effect on the current Arizona electric transmission system. Transmission owners shall provide the technical reports, analysis or basis for projects that are included for serving customer load growth in their service territories."

Attachment A to this Plan is the Generator Interconnection Study prepared for Mead Phoenix Project Participants by PDS Consulting. The Generator Interconnection Study shows the effect of the Project on the affected transmission systems within the western region.

With respect to transmission lines:

1. "The size and proposed route of any transmission lines":

The Gen-Tie Line will be a 500 kV transmission line on a single set of towers that will connect the Project generator to a new 500 kV switchyard to be constructed and owned by MPP (the "MPP Switchyard") located in the northeast quarter of the northeast quarter of Section 9, Township 26 North, Range 16 West, Gila and Salt River Base and Meridian (G&SRB&M), Mohave County, Arizona. The MPP Switchyard will be located near the existing Mead Phoenix Project 500 kV transmission line, which will be looped in-and-out of the MPP Switchyard.

The Gen-Tie Line route will be wholly within the Project site, a distance of approximately 5 miles, running from the power block area on the north central edge of the Project site to the MPP Switchyard. The proposed Gen-Tie Line route is within Township 26 North, Range 16 West, Gila and Salt River Base and Meridian (G&SRB&M), Mohave County, Arizona, extending from the center of Section 20 north to the southeast corner of Section 17, then to the northeast corner of Section 17, then to the southwest corner of Section 9, then to the northwest corner of Section 9, then to the northeast corner of Section 9, where it connects to the MPP Switchyard.

2. "The purpose to be served by each proposed transmission line":

The Gen-Tie Line will interconnect the new generator to the new MPP Switchyard, through which the Project will be interconnected to the electric grid via a loop in-and-out of the existing Mead Phoenix Project 500 kV line.

3. "The estimated date by which each transmission line will be in operation":

The Gen-Tie Line, MPP Switchyard and loop interconnection are anticipated to be in operation in late 2012 to support startup and testing of the Project.

This Plan is respectfully submitted this 10th day of August 2009.

Hualapai Valley Solar LLC

By:

Greg Bartlett
Managing Director

Attachment A: *Generator Interconnection Study*

ATTACHMENT A

Mohave Sun Power, LLC

Hualapai Valley Solar Project
Generator Interconnection Study

Final Report

Prepared For
MPP Project Participants

Prepared By

June 30, 2009

Table of Contents

APPENDICES (To Be Provided Upon Request)

Appendix A: Power Flow Study Results

Appendix B: Post-Transient Study Results

Appendix C: Transient Stability Study Results

Appendix D: EOR9300 Sensitivity Study Results

Hualapai Valley Solar Project
Generator Interconnection Study

I. EXECUTIVE SUMMARY

Mohave Sun Power, LLC (Customer) has submitted a completed generator interconnection application to the Mead-Phoenix Project (MPP) Operating Agent, the Salt River Project (SRP) for the Hualapai Valley Solar Project (HVSP or Project). The Project would be comprised of a single 340 MW gross concentrated solar steam turbine fueled by a solar collector system. The total maximum plant net output to the MPP transmission system is expected to be approximately 260 MW. The Project will be located in the Mohave County, Arizona and will build about 5 miles radial 500 kV line to its interconnection point to be looped into the MPP's existing Mead-Perkins 500 kV line. The proposed Hualapai Valley 500 kV interconnection point will be approximate 50 miles from the Mead 500 kV substation. The planned commercial operation date for the Project is 2013.

The Customer has requested both Network and Energy Resource Interconnection Services for the Hualapai Valley Solar Project. MPP participants have determined that a System Impact Study (SIS) is required to determine the impact of the proposed Project on MPP transmission facilities and the interconnected transmission system. The Customer has selected a third party contractor, PDS Consulting, PLC (PDS), to perform the SIS for the Project. This Generator Interconnection Study (GIS) was performed using the modified and updated 2013 heavy autumn base case based on approved WATS 2011 heavy autumn base case. The SIS has included power flow, post-transient, transient stability and short circuit analyses to determine the impact of the Hualapai Valley Solar Project on the interconnected transmission system. It has been noticed that a prior High Queue generation project has made an interconnection request to the MPP line, therefore, two interconnection configuration scenarios were evaluated: with both the High Queue Generation Project (500 MW) and the Hualapai Valley Solar Generation Project (260 MW) combined scenario and with only the Hualapai Valley Solar Project (260 MW) scenario. The performance of the transmission system was measured using the WECC Reliability Criteria and North American Electric Reliability Council (NERC) Planning Standards.

The overall system impact is acceptable on the Perkins-Mead 500 kV line as well as on the EOR path rating of 10,500 MW achieved by the combined EOR9300 and DPV2 Projects together as demonstrated from this interconnection impact study. No transmission upgrade on the Perkins-Mead 500 kV line is required; however, it is necessary to move the Mead series capacitor bank to the new location of the proposed Hualapai 500 kV interconnection point toward to Perkins. The study results indicate no significant negative impact to the interconnected transmission system.

A sensitivity study was conducted with respect to recent SCE announcement of DPV2 system development change. No negative impacts related to the HVSP interconnection on the EOR path rating of 9,300 MW without DPV2.

II. INTRODUCTION

Mohave Sun Power, LLC (Customer) has submitted a completed generator interconnection application to the Mead-Phoenix Project (MPP) Operating Agent, the Salt River Project (SRP) for the Hualapai Valley Solar Project (Project). The Project would be comprised of a single 340 MW gross concentrated solar thermal generation unit. The total maximum plant net output to the MPP transmission system is expected to be approximately 260 MW. The Project will be located in the Mohave County, Arizona and its interconnection station will be looped into the MPP's existing Mead-Perkins 500 kV line. The planned commercial operation date for the Project is 2013.

The Customer has requested both Network and Energy Resource Interconnection Services for the Project. MPP participants have determined that a System Impact Study (SIS) is required to determine the impact of the proposed Project on MPP transmission facilities and the interconnected transmission system. The Customer has selected a third party contractor, PDS Consulting, PLC (PDS), to perform the SIS for the Project. The SIS will include power flow, post-transient, transient stability and short circuit analyses.

It has been noticed that a prior High Queue generation project has made an interconnection request to the MPP line, therefore, two interconnection configuration scenarios were evaluated: with both the High Queue Generation Project (500 MW) and the Hualapai Valley Solar Generation Project (260 MW) combined scenario and with only the Hualapai Valley Solar Project (260 MW) scenario. The interconnection point of the High Queue generation project indicated a distance of 210 miles away from Perkins and 35 miles toward Mead. The proposed interconnection point of the Hualapai Valley Solar Project is in the near vicinity: a distance of 193 miles away from Perkins and 50 miles toward Mead.

The scope of the analysis is to identify the transmission system impacts caused solely by the addition of the Hualapai Valley Solar Project, and to identify the system reinforcements, if any, necessary to mitigate the adverse impact of the Project under different system operating conditions. The majority of the work was based the projected transmission configuration which included the combined EOR 9300 and DPV2 projects for the EOR path rating of 10,500MW as originally planned for the 2013 time frame.

At the request of the MPP review members, a sensitivity study of the EOR path rating of 9,300 MW without DPV2 was performed to evaluate the impact due to the change of system configuration announced recently by Southern California Edison Company.

III. PROJECT AND INTERCONNECTION INFORMATION

Table 1 provides general project and interconnection information about the Hualapai Valley Solar Project.

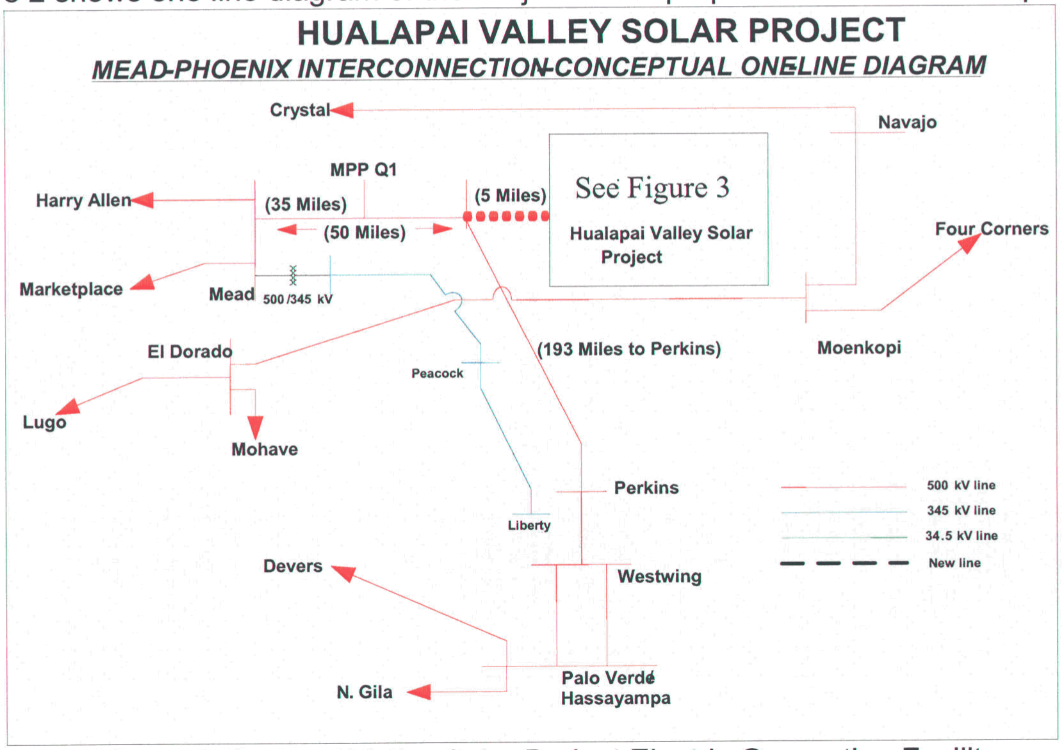
Table 1: Hualapai Valley Solar Project—Technical Parameters

Project Location	Mohave County, Arizona
Number and Type of Generators	377 MVA Steam Turbine (one)
Maximum Generator Output	340 MW
Generator Auxiliary Load	80MW (0.90 P.F. lagging)
Maximum Net Output to MPP's System	260 MW
Power Factor	+/- 0.90
Step-up Transformer	415 MVA, 21/500 kV Delta/Wye transformer, Z=12.5% on a 330 MVA base
Interconnection Configuration	Project will interconnect via a 5-mile 500kV line and would connect via a new breaker-and-a-half substation to MPP's Perkins-Mead 500 kV line.
Interconnection Voltage	500 kV

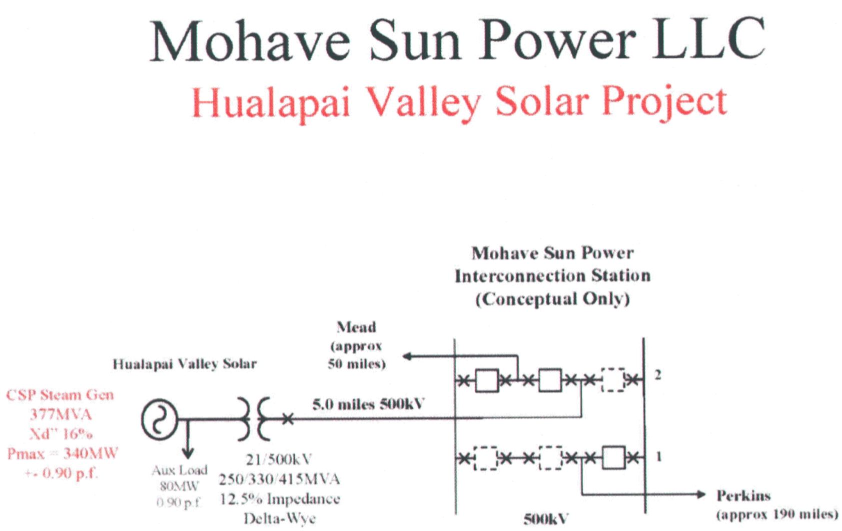
Figure 1 depicts the Hualapai Valley Solar Project interconnection point and the existing transmission system at the interconnection vicinity.

Figure 1: Hualapai Valley Solar Project interconnection point

Figure 2 shows one line diagram of the Project at the proposed interconnection point



: Figure 3 Hualapai Valley Solar Project Electric Generation Facility



April 5, 2009

IV. STUDY BASE CASE DESCRIPTION AND ASSUMPTIONS

The SIS was conducted using the original Western Arizona Transmission Study (WATS) Group already approved 2011 heavy autumn base case. Several base cases had been expanded based on this original base case for a higher queue preceding project. For benchmarking purpose, these 2011 heavy autumn base cases were further modified and updated to become 2013 heavy autumn base cases. All approved transmission projects that will be operational by autumn of 2013 were modeled. The 2013 heavy autumn pre-project base case with Path 49 flow at 10,500 MW have the following projects modeled:

- EOR9300 Project (sponsored by SRP)
- Palo Verde-Devers No. 2 Project (Sponsored by SCE)

The Pre-Project base cases were developed according to the following scenario:

Model with the higher queue project(s): The proposed generation project in the MPP participants control area that has an interconnection queue date ahead of the Hualapai Valley Solar Project was modeled and included in this analysis.
The following major assumptions were made in developing the Pre-Project base cases.

- Perkins phase shifting transformers was modeled out of service.
- Path 49 flows were modeled at 10,500 MW.
- Mohave power plant was not dispatched.
- The higher queue preceding project generation was dispatched according to their Network Resource or Energy Resource designation.

The Pre-Project base cases were tested to ensure that all transmission facilities in MPP participants control areas are within their normal operating limits. While it is impossible to study all combinations of system load and generation levels during all seasons, these Pre-Project base cases represent extreme loading and generation conditions for the MPP participants control areas. However, MPP participants cannot guarantee that the Hualapai Valley Solar Project can operate at maximum rated output year round without impacting the transmission system during times and seasons not studied.

Post-Project base cases were developed from the Pre-Project cases. The Post-Project base cases were modeled the proposed Hualapai Valley Solar Project as depicted in Figure 3. The Hualapai Valley Solar Project was modeled as one solar collector system comprised of 340 MW gross, 260 MW net output steam generating unit for the power flow and stability analysis. The series capacitor bank at the Mead end of the Mead-Perkins 500 kV line was modeled to be relocated to the Project's interconnection point toward Perkins.

Five scheduling scenarios were developed. The 260 MW output of the proposed project was scheduled according to the following five scheduling scenarios depicted in Table 2.

Table 2: Generation Scheduling Scenarios

Scheduling Scenarios	Higher Queue Preceding Project Net Output (MW) Pre-Project	Hualapai Valley Solar Project Net Output (MW) Post-Project	Power Scheduled to CAISO (MW)	Power Scheduled to Arizona (MW)	Displaced Generation
Case A	500	260	0	760	Merchant generators at Palo Verde hub
Case B	500	260	760	0	Peaking Units in CAISO control area
Case C	500	260	380	380	Merchant generators at Palo Verde hub and Peaking Units in CAISO control area
Case D	0	260	0	260	Merchant generators at Palo Verde hub
Case E	0	260	260	0	Peaking Units in CAISO control area

V. STUDY METHODOLOGY AND EVALUATION CRITERIA

1. System Impact Study Cases

Power flow, transient stability, post-transient and short circuit analyses were performed on both the pre-project and the post-project base cases to determine the impact of the Hualapai Valley Solar Project on the interconnected transmission system.

- **Pre-Project Base Case (**2013 Heavy Autumn Case Pre-Project_2013hac00.sav)

The existing WATS power flow case identified below has reviewed and further updated to measure the Pre-project performance.

This benchmark case was developed to study the impact of the interconnection of Hualapai Solar Project. This pre case has no High Queue Generation Project (500 MW) and no Hualapai Valley Solar Generation Project (260 MW) project. In the pre case, today's transmission configuration for max EOR equal to 10,500 MW and Perkins-Mead flow equal to 1923 MW was maintained, and ensured no system reliability problem. The significant information is shown below:

Monitored	Path 49 Flow	Flow Metering @ Perkins	Flow Metered @ Mead	Comments
Both Ends of the Perkins-Mead 500 kV line	10500 MW	1923 MW	1847 MW	Difference in flow between the two metering locations is attributed to losses on the line segment between the two locations

The Pre-Project base case was tested to ensure compliance with WECC/North American Electric Reliability Corporation (NERC) and other affected company planning standards.

- **Post-Project Base Cases**

As described in Table 2 of the previous section, the following post-project base cases were developed for SIS evaluation consideration:

i. Post Case A (760MW to AZ): Post Case A.sav
ii. Post Case B (760MW to CA): Post Case B.sav
iii. Post Case C (380MW Ea. to AZ & CA): Post Case C.sav
iv. Post Case D (260MW to AZ): Post Case D.sav
v. Post Case E (260MW to CA): Post Case E.sav

i. Post Case A (Scenario A: 760 MW to AZ):
This post case was modeled with both High Queue Project (500 MW) and Hualapai Valley Solar Project (260 MW) and connected on-line. The total power of 760 MW was scheduled to Arizona and the generation was displaced with merchant generation at Palo Verde Hub in Arizona. The significant information is shown below:

Monitored	Path 49 Flow	Flow Metered @ Perkins	Flow Metered @ Mead	Comments
Both Ends of the Perkins-Mead 500 kV line	9806 MW	1516 MW	2217 MW	Difference in flow between the two metering locations is attributed to two project generation injections

ii. Post Case B (Scenario B: 760 MW to CA):

This post case was modeled with both High Queue Project (500 MW) and Hualapai Valley Solar Project (260 MW) and connected on-line. The total power of 760 MW was scheduled to CAISO and the generation was displaced with generation units in California. The significant information is shown below:

Monitored	Path 49 Flow	Flow Metering @ Perkins	Flow Metered @ Mead	Comments
Both Ends of the Perkins-Mead 500 kV line	10500 MW	1640 MW	2333 MW	Difference in flow between the two metering locations is attributed to two project generation injections

iii. Post Project Case C (Scenario C: 380 MW to AZ and 380 MW to CA)

This post case was modeled with both High Queue Project (500 MW) and Hualapai Valley Solar Project (260 MW) and connected on-line. The total power of 760 MW was split equally between Arizona and California. Generation of 380 MW each was scheduled to Arizona and California and generation was displaced with generation units in Arizona and California. The significant information is shown below:

Monitored	Path 49 Flow	Flow Metering @ Perkins	Flow Metered @ Mead	Comments
Both Ends of the Perkins-Mead 500 kV line	10166 MW	1605 MW	2300 MW	Difference in flow between the two metering locations is attributed to two project generation injections

iv. Post Case D (Scenario D: 260 MW to AZ)

This post case was modeled with Hualapai Solar Project (260 MW) and connected on-line. The generation net output of 260 MW was scheduled to Arizona and the generation was displaced with merchant generation at Palo Verde Hub in Arizona. The significant information is shown below:

Monitored	Path 49 Flow	Flow Metering @ Perkins	Flow Metered @ Mead	Comments
Both Ends of the Perkins-Mead 500 kV line	10306 MW	1836 MW	2024 MW	Difference in flow between the two metering locations is attributed to Hualapai project generation injection

v. Project Case E (Scenario E: 260MW to CA)

This post case was modeled with Hualapai Solar Project (260 MW) and connected on-line. The generation net output of 260 MW was scheduled to California and the generation was displaced with generation units in California. The significant information is shown below:

Monitored	Path 49 Flow	Flow Metering @ Perkins	Flow Metered @ Mead	Comments
Both Ends of the Perkins-Mead 500 kV line	10500 MW	1893MW	2077 MW	Difference in flow between the two metering locations is attributed to Hualapai project generation injection

2. Selecting Appropriate Post-Project Base Cases for System Impact Study

The following is a power flow summary of the Pre-Project and five Post-Project cases which were represented with different dispatch scenarios.

Base Case Scenario	PRE-C00 Benchmark	Post-A 760 MW To AZ	Post-B 780 MW To CA	Post-C 380 MW Ea. To AZ& CA	Post-D 260 MW To AZ	Post-E 260 MW To CA
EOR	10500 MW	9806 MW	10500 MW	10166 MW	10306 MW	10500 MW
PERKINS-MEAD @ PERKINS	1923 MW	1516 MW	1640 MW	1605 MW	1836 MW	1893MW
PERKINS-MEAD @ MEAD	1847 MW	2217 MW	2333 MW	2300 MW	2024 MW	2077 MW

It should be pointed out that the SIS study was focused on the Post-Project Case B and Case E. These are the worst case scenarios in evaluating whether the reliability performance impact on the EOR rating of 10,500MW can be preserved. It is not necessary to maintain the Perkins-Mead line flow to be 1,923 MW due to the new generation injection into the line.

The clarification of this issue is important in consideration of the interconnection of new generation projects such as “High Queue” and/or “Hualapai Valley Solar”, the EOR path rating of 10,500 MW should not be impacted irrespective to dispatching conditions of the proposed generation projects whether the power scheduled to CA and/or to AZ. This is the fundamental principle for preserving the existing path rating. Therefore, it will not be necessary to evaluate the Cases A, C and D which showed EOR flow was less than 10,500 MW. These base cases are strictly for information purposes only.

Specific studies to be conducted and their evaluation criteria are outlined below:

A. Power Flow Analysis

Power flow analysis was performed on both the pre-project and post-project base cases for the 2013 heavy autumn operating conditions. The two Post-Project base cases

(Cases B & E) were used to examine the impact of the Project during normal operating conditions (N-0), as well as single (N-1), and selected multiple contingencies. The N-1 and selected multiple contingencies simulated include:

- All single (230-500 kV) transmission circuit outages within the vicinity of the project.
- All single transformer outages within the vicinity of the project.
- Selected outages of double circuit tower lines (230-500 kV) within the vicinity of the project.

The WECC/NERC planning standards were used to assess the adequacy of the study results. The power flow analysis related evaluation criteria that were used in the study are summarized below:

Evaluation Criteria:

- Under normal conditions, bus voltages must be maintained between 0.95 P.U. and 1.05 P.U. unless previously defined minimum voltage or var scheduling requirements exist. All transmission line and transformer loadings should be within normal continuous ratings.

- Under emergency or contingency conditions, the following limits or constraints were applied.

  a. No transmission element should be loaded above its emergency rating as defined by the operating entity or the base case used in the analysis. Ratings for most major Southwest facilities are provided in Appendix A.

  b. Equipment emergency voltage limits should not be exceeded.

  c. Bus voltage deviations determined thru the analyses should not exceed planning limits. A representative list for the Southwest is provided in Appendices B and C.
  d. Maximum voltage deviation allowed at all buses under contingency conditions must be 5% and 10% for N-1 and N-2 contingencies respectively, SCE will allow up to 7% under certain N-1 contingencies.

  e. No load shedding should be allowed for single contingencies unless previously defined (e.g. consequential load loss, supplemental load loss, load reduction, consequential generation loss, remedial action scheme, etc.).

The following selected contingency outages were simulated (but not limited to):

<u>N-1:</u>
- Perkins-Mead 500 kV Line (Pre-Project)

- Perkins-Hualapai Valley Interconnection Point 500 kV Line (Post-Project)
- Hualapai Valley Interconnection Point-Mead 500 kV Line (Post-Project)
- Higher Queue Interconnection Point-Mead 500kV Line (Post-Project)
- Navajo-Crystal 500 kV Line
- Moenkopi-Eldorado 500 kV Line
- Hassayampa-North Gila 500 kV Line
- Palo Verde-Devers 500 kV Line
- Harquahala -Devers 500 kV Line
- Mead-Marketplace 500 kV line
- Crystal-McCullough 500 kV Line
- Marketplace-Adelanto 500 kV Line
- Marketplace-McCullough 500 kV Line
- McCullough-Eldorado 500 kV Line
- McCullough-Victorville #1 500 kV Line
- McCullough-Crystal 500 kV Line
- Eldorado-Lugo 500 kV Line
- Mohave-Lugo 500 kV Line
- Victorville-Lugo 500 kV Line

N-2:

- Palo Verde-Devers & Harquahala-Devers 500 kV Lines
- Palo Verde-Westwing #1 & #2 500 kV Lines

B. Post Transient Analysis

Post-transient analysis was performed for all contingencies considered at risk based on power flow analysis.

Study assumptions:

1. All loads were modeled as constant MVA during the first few minutes following an outage or disturbance.

2. All voltages at distribution substations were restored to normal values by transformer tap changers (LTC) and other voltage control devices.

3. Generator MVAR limits were modeled as a single value for each respective limit (i.e. QMAX and QMIN) for each generator.

4. No manual operator intervention is allowed to increase the generator Mvar flow.

5. Remedial Action Schemes or Special Protection Systems such as generator dropping, load shedding or blocking of automatic generator control (AGC) were not considered for single contingencies.

6. Solution assumptions were included for this analysis:

   a. Area interchange: Disabled for reactive margin analysis, enabled for voltage deviation.
   b. Governor blocking: Base load flag will be used per WECC practice.
   c. DC Converter transformer tap adjustment: Enabled.
   d. Generator voltage remote control: Enabled for selected units plus Palo Verde #1-#3.
   e. Phase shifter control: Disabled

7. Switched shunt devices: Enabled for voltage deviation and disabled for reactive margin.

8. Single-contingency disturbances to be used in the post-transient stability studies were the same as those studied in the Power Flow section (section A).

9. Credible double-contingency disturbances listed in the power flow analysis section were used in the post-transient stability studies.

10. Power flow margins were added to the project path rating; a 5 % for N-1 contingency test and a 2.5% for the N-2 contingency test.

The post-transient analysis was conducted and evaluated based on the assumptions that the maximum voltage deviations allowed under contingency conditions in the post-transient time frame are 5% for N-1, and 10% for N-2 as shown in Table 3, unless a lower standard has been previously adopted on selected buses.

Table 3: Post-Transient Voltage Criteria Limits

WECC Reliability Criteria for the Post-Transient Voltage Deviations

B	**N-1**	**5% ***
C	**N-2**	**10%**
D	**N-3**	**Cascading Not Permitted**

* SCE buses allowed deviating 7%

All outages were simulated using governor power flow tools. Remedial actions for each outage were modeled according to the latest WECC Operating Studies Subcommittee (OSS) Handbook.

C. Transient Stability Analysis

Transient stability studies were conducted on both the pre-project and post-project base cases for the 2013 heavy autumn operating conditions. Transient stability runs were simulated for 10 seconds to ensure the system is stable and positively damped.

Selected critical contingency will be simulated. Provided below are the outages:

N-1:

- Perkins-Mead 500 kV Line (Pre-Project)
- Perkins-Hualapai Valley Interconnection Point 500 kV Line (Post-Project)
- High Queue Interconnection Point-Mead 500 kV Line (Post-Project)
- Hassayampa-North Gila 500 kV Line
- Palo Verde-Devers 500 kV Line
- Harquahala-Devers 500 kV Line
- Hassayampa-North Gila 500 kV Line
- Navajo-Crystal 500 kV Line
- Moenkopi-Eldorado 500 kV Line
- Mead-Marketplace 500 kV Line
- Marketplace-Adelanto 500 kV Line
- Crystal-McCullough 500 kV Line
- McCullough-Victorville #1 500 kV Line
- Eldorado-Lugo 500 kV Line
- Mohave-Lugo 500 kV Line
- Victorville-Lugo 500 kV Line

N-2:

- Palo Verde-Westwing 500 kV #1 and 2 Lines
- Palo Verde-Devers and Harquahala-Devers 500 kV Lines
- McCullough-Victorville 500 kV #1 and 2 Lines
- IPPDC Bi-Pole
- Crystal-McCullough and Harry Allen-Mead 500 kV Lines
- Palo Verde Generating units 1 and 2

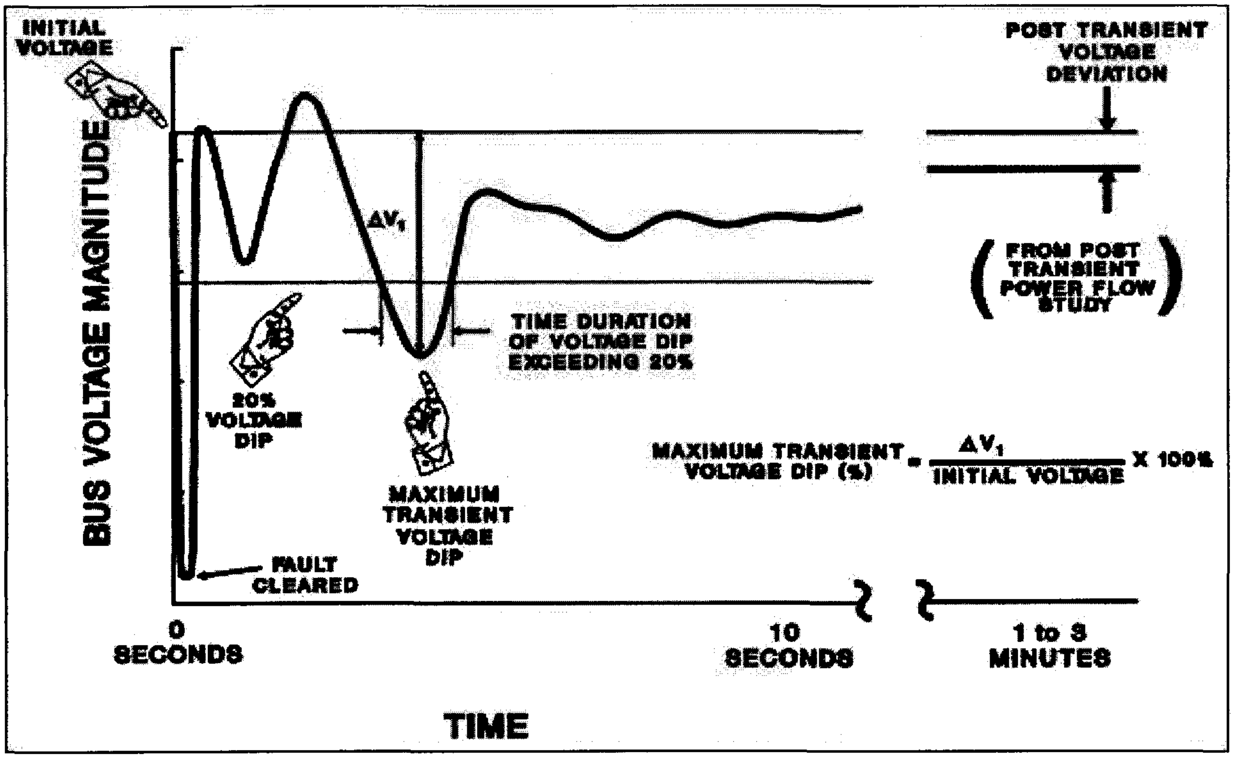
The following WECC transient voltage dip and transient frequency criteria were used to evaluate the impact of the project. A summary of the transient stability analysis evaluation criteria is provided in Table 4 and depicted graphically in Figure 4.

- WECC transient voltage dip criteria: The transient voltage dip must not exceed 25% at load buses or 30% at non-load buses for N-1 contingency. For N-2 contingency, the transient voltage dip must not exceed 30% at any bus. The maximum duration of a transient voltage dip larger than 20% at load buses must not exceed 20 cycles for N-1 contingency or 40 cycles for N-2 contingency.
- WECC transient frequency criteria: The transient frequency for N-1 contingency must not be below 59.6 Hz for 6 cycles or more at load bus. For N-2 contingencies, the transient frequency must not be below 59.0 Hz for 6 cycles or more at load bus.

Table 4: Stability and Post-transient Analysis Evaluation Criteria

NERC and WECC Categories	Outage Frequency Associated with the Performance Category (outage/year)	Transient Voltage Dip Standard	Minimum Transient Frequency Standard	Post -Transient Voltage Deviation Standard
A System normal	Not Applicable	Nothing in addition to NERC		
B One element out-of-service	≥ 0.33	Not to exceed 25% at load buses or 30% at non-load buses. Not to exceed 20% for more than 20 cycles at load buses.	Not below 59.6Hz for 6 cycles or more at a load bus.	Not to exceed 5% at any bus.
C Two or more elements out-of-service	0.033 – 0.33	Not to exceed 30% at any bus. Not to exceed 20% for more than 40 cycles at load buses.	Not below 59.0Hz for 6 cycles or more at a load bus.	Not to exceed 10% at any bus.
D Extreme multiple-element outages	< 0.033	Nothing in addition to NERC		

Figure 4: Graphical Representation of Stability Analysis Evaluation Criteria



D. Short Circuit Analysis

Short circuit studies were performed to evaluate the impact of the addition of the Hualapai Solar Project on selected MPP participant's substation breaker duties. The studies were conducted in accordance with MPP requirements.

For this interconnection study, PDS used the current short circuit data with updated system equivalent data and incorporated the Hualapai Valley Solar Project for the assessment of the post-Project system scenarios. For the pre-Project case, PDS used the current data base for the 2013 time frame and included system upgrades as required.

E. Perkins-Mead 500 kV Line Metering

It is important to have multiple metering points when having proposed generation project(s) interconnected with the existing line. This information is significant and important for any generation interconnection in particular with respect to each of the interconnection point.

Because both of the "High Queue" and Hualapai Valley Solar Projects are to be located closer to the Mead Substation, the injected generation tended to flow significantly more to Mead than to Perkins, regardless of the power dispatch schedules from both projects. Nevertheless, the power flows from Perkins to any proposed generation interconnection points tended to decrease because of the power flow displacement as attributed by the impedance path.

For this generation impact study, the attention was focused on the actual flows metering at both ends of the Perkins-Mead 500kV line, but not the intermediate interconnection points because a full output schedule from each project has been known, and the lines losses are not the concern of this impact study. These two metering points; Perkins and Mead 500kV buses are appropriate and adequate for the security control for Arizona EHV system operator and/or CAISO. The table below depicts this specific information:

Base Case Scenario	PRE-C00 Benchmark	Post-B 780 MW To CA	Post-E 260 MW To CA
EOR	10500 MW	10500 MW	10500 MW
PERKINS-MEAD @ PERKINS	1923 MW	1640 MW	1893MW
PERKINS-MEAD @ MEAD	1847 MW	2333MW	2077 MW

VI. STUDY RESULTS

A. Power Flow Analysis Results

The key finding from the power flow analysis is that the proposed generation project interconnection can achieve a reliable system performance in the Mead-Phoenix 500 kV line and non-simultaneous rating of Path 49 while meeting the thermal and voltage limits of the transmission system. The results show no negative impact to the interconnected transmission system.

The "Power Flow Diagrams of Base Cases and Contingency Cases" are provided in Appendix A. The "Power Flow Analysis Summary," which lists the highest transmission emergency loadings for critical contingency conditions, is provided in PF-Tables 1 &2 in the attachments of the report. The following subsections provide highlights of the analysis.

- **<u>No Impact on Perkins-Mead 500 kV Line</u>**

The base case power flows measuring at the Perkins end were ranged from 1,640 MW (with a 760 MW injection) to 1,893 MW (with a 260 MW injection) depending upon the magnitudes of generation injection from the interconnection point(s). The flows were much higher: 2,333 MW for a 760 MW injection, and 2,077 MW for a 260 MW injection when measuring at the other end at Mead. This should be considered to be acceptable from the base case power flow perspective.
From the system reliability viewpoint, the thermal loadings and bus voltages were within the criteria limits under base case and critical single contingency outage conditions.

- **<u>No Impact on Path 49 EOR Rating</u>**

Path 49 rating is not impacted by the looping of the Perkins - Mead 500 kV line through the proposed Hualapai Valley 500 kV Substation. As depicted from Tables PF-Tables 1 & 2, the looping of the Perkins – Mead 500 kV line through the proposed Hualapai 500 kV Substation did not cause the flow to increase on the limiting facility, the Moenkopi-El Dorado 500 kV line, following the outage of Navajo - Crystal 500 kV line. The emergency loadings on the Moenkopi - El Dorado 500 kV line were held constant at 96% of the its short-term rating irrespective of having a 760 MW or a 260 MW generation injection into the Perkins-Mead 500 kV line with Path 49 rating of 10,500 MW following the outage of Navajo – Crystal 500 kV line.
The following subsections provide highlights of the analysis:

1. No transmission element was loaded above 100% of its continuous rating under base case conditions in the Pre-and-Post-Project cases. The highest loadings are shown in the table below:

Limiting Element	Emergency Loading (%) Pre-Project	Post-Project B	Outage
Moenkopi-Eldorado Series Cap	96.0	96.0	NV-CR

Limiting Element	Emergency Loading (%) Pre-Project	Post-Project E	Outage
Moenkopi-Eldorado Series Cap	96.0	96.0	NV-CR

2. The Liberty 230kV phase shifter was loaded slightly above or at 100% of its emergency for an outage of the Queue1-Mead 500kV line segment in the Post-Project cases B and E, respectively. The highest loadings are shown in the table below:

Limiting Element	Emergency Loading (%) Pre-Project	Post-Project B	Outage
Liberty 230kV Phase Shifter	97.0	102.9	Q1-MD

Emergency Loading (%) Limiting Element	Pre-Project	Post-Project E	Outage
Liberty 230kV Phase Shifter	97.0	100.0	Q1-MD

This overload problem in the Post-Project Case E can be resolved with the following mitigation alternatives:

Alternative 1: By-passing the Liberty 230kV phase shifty would eliminate the Liberty 230kV phase shifter overload problem. No other overloads were detected. The highest loadings were 90% on the Moenkopi-Eldorado 500kV line and 84.5% on the Liberty-Peacock 345 kV line, respectively.

By-Passed LBTY PST Limiting Element	Emergency Loading (%) LBT PST I/S	LBT PST B/P	Outage
Moenkopi-Eldorado Series Cap	88.7	90.0	Q1-MD
Liberty-Peacock 345kV Line	90.5	84.5	Q1-MD

Alternative 2: Reducing a total of 360 MW of new project generation; the Hualapai Valley Solar Project generation 260 MW and High Queue generation 100 MW would overcome the Liberty 230kV phase shifter to its 100% of its emergency rating.

Reduced Project Generation Limiting Element	Emergency Loading (%) No Reduction	W/ Reduction	Outage
Liberty 230kV Phase Shifter	103.0	100.0	Q1-MD

- **No Impact on Existing transmission System**

The addition of the Hualapai Valley Solar Project did not trigger any new transmission facility to overload under normal operating conditions or following the outages simulated. The voltage profile of the existing transmission system was not impacted during normal and under contingency conditions.
The following subsections provide highlights of the analysis:

1. For the double line outage of the Palo Verde-Westwing 500 kV No. 1 and 2 lines in the pre-project case, the highest loadings are shown in the table below: shown in the table below.

	Emergency Loading (%)		
Limiting Element	Pre-Project	Post-Project B	Outage
Hat WALC-Hassyamp	111.0	107.0	PV-WW1&2

	Emergency Loading (%)		
Limiting Element	Pre-Project	Post-Project E	Outage
Hat WALC-Hassyamp	111.0	111.0	PV-WW1&2

The "pre-existing" overload violation of the 5.93 mile 230 kV line would be resolved between Western and CAWCD with respect to CAWCD's requested 230 kV tie open between its Hassayampa Pumping Plant and APS' planned TS5 500/230 kV station. No other overloads were detected after a transfer trip of this local 230 kV tie.

2. For the double line outage of the Palo Verde-Devers and Harquahala-Devers 500kV lines in the pre-project and post-project cases, the highest loadings are shown in the table below:

	Emergency Loading (%)		
Limiting Element	Pre-Project	Post-Project B	Outage
Hat WALC-Hassyamp	106.0	108.0	DPV1&2
Perkins-Mead	108.0	102.0	DPV1&2
Westwing-Perkins	106.0	100.0	DPV1&2

	Emergency Loading (%)		
Limiting Element	Pre-Project	Post-Project E	Outage
Hat WALC-Hassyamp	106.0	106.0	DPV1&2
Perkins-Mead	108.0	107.0	DPV1&2
Westwing-Perkins	106.0	106.0	DPV1&2

For the double line outage of the Palo Verde-Devers and Harquahala-Devers 500 kV lines in the pre-project case, loadings of 106.0% of the emergency rating of the Hassayampa-HatWALC 230 kV line, 108.0% of the emergency rating of the series capacitor of the Mead-Perkins 500 kV line and 106.0% of the emergency rating of the Perkins-Westwing 500 kV line occurred. All of these overloads were identified as a pre-existing condition based on results of the "DPV2 Accepted Path 49 Rating Study Report."Overload of the Hassayampa-HatWALC 230 kV line would be resolved for an acceptable mitigation between affected parties as described in the previous section.

Implementing an SPS, which sheds an appropriate amount of load in SCE's system, would mitigate the thermal overloads on the Westwing-Perkins and Perkins-Hualapai 500kV lines caused by the double line outage of the Palo Verde-Devers and Harquahala-Devers 500 kV lines.

B. Post-Transient Analysis

The key finding from the post-transient analysis is that the proposed generation project interconnection can achieve a reliable system performance in the Mead-Phoenix 500 kV line and non-simultaneous rating of Path 49, while meeting the post-transient voltage criteria limits of the transmission system. The results show no negative impact to the interconnected transmission system.

The "Post-Transient Power Flow Diagrams of Base Cases and Contingency Cases" are provided in Appendix B. Post-transient analysis was performed on selected critical outages (outage list is the same as power flow contingency list). The "Post-transient Analysis Summary," which lists the voltage performance levels for critical contingency conditions, is provided in PT-Tables 1 & 2 in the attachments of the report. The following provides highlights of the analysis.

- The transmission system post-transient voltage deviations were within the 5% criteria limit for any N-1 contingencies with the interconnection of the proposed generation project(s) into the Perkins - Mead 500 kV line.

- The transmission system post-transient voltage deviations were within the 10% criteria limit for any N-2 contingencies with the interconnection of the proposed generation project(s) into the Perkins - Mead 500 kV line.

C. Transient Stability Analysis

The key finding from the transient stability analysis is that the proposed generation project interconnection can achieve a reliable system performance in the Mead-Phoenix 500 kV line and non-simultaneous rating of Path 49 while meeting the voltage dip, damping and frequency deviation limits of the transmission system. The results show no negative impact to the interconnected transmission system.

The "Transient Stability Plots" are provided in Appendix C. Transient stability analysis was performed on selected critical outages (outage list is the same as post-transient contingency list). The "Transient Stability Analysis Summary," which lists the dynamic stability performance levels for critical contingency conditions, is provided in TS-Tables 1 & 2 in the attachments of the report. The following provides highlights of the analysis.

- Stable and adequately damped transient stability performances were achieved following all the outages simulated.
- No violation of WECC transient voltage dip criteria was found following all the outages simulated.

D. Short Circuit Analysis

A short circuit study and breaker capability analysis has been performed to determine the incremental impact of the generation addition proposed with the Hualapai Valley Solar Project.

Study Data

To perform the short circuit study, the Hualapai Valley Solar Project (HVSP) generation addition was modeled in the MPP short circuit case using the ASPEN One-Liner software.

The following data was used to prepare the short circuit case:

500 kV Line Impedances (HUALPOI is the Point of Interconnection with MPP)

MPPQ1 – HUALPOI	Z1=0.00010 + j0.00310 p.u. Z0=0.00030 + j0.00930 p.u.
HUALPOI - PERKINS	Z1=0.00180 + j0.03970 p.u. Z0=0.00540 + j0.11910 p.u.
Series Capacitors at each end	Z1=0.00000 – j0.01750 p.u.
HUALPOI – HSPSITE	Z1=0.00010 + j0.0024 p.u. Z0=0.00030 + j0.0072 p.u.

Generator Step-up Transformers (one)
525/21.0kV (Y-Grounded/Delta)
X1 = 4.5% on 100.0 MVA base
X0 = 4.5% on 100.0 MVA base

Generator (one)
Machine Base = 377 MVA (21.0KV)

Steam Turbine Generator = Xd" = 0.160 p.u.

The following table, Table 6, is includes a small cross-section of the buses faulted for this analysis, sorted by three-phase incremental (post-project compared to the pre-project base case).

Table 6: Short Circuit Results, Sorted by Incremental Three-Phase Value

					PRE - Hualapai Valley Solar Project				POST - Hualapai Valley Solar Project				INCREMENTAL	
NO	BUS	KV	LOCATION	AREA	3LG(A)	X/R	1LG(A)	X/R2	3LG(A)3	X/R4	1LG(A)5	X/R6	3LG (A)	1LG (A)
0	HSPGEN	21		14	0	0	0	0	116,918	117.18	92,187	209.12	116,918.1	92,186.9
15992	HSPSITE	525		14	0	0	0	0	15,397	9.06	9,987	16.15	15,397.4	9,987.0
15990	HUALPOI	525		14	20,437	6.42	9,236	13.05	21,647	6.81	12,206	13.46	1,209.8	2,969.9
3007	PERKINS	525	PERKINS	14	35,272	16.11	25,066	17.43	35,933	15.57	25,397	17.12	660.8	330.6
9650	WESTWING	525	WESTWING	14	36,065	15.91	25,858	16.98	36,720	15.4	26,188	16.69	654.8	330.6
15999	MPPQ1	525		14	19,591	9.71	10,548	15.79	20,237	10.38	12,394	16.93	646.3	1,845.8
2894	WESTWING	230	WESTWING	14	52,992	18.31	41,325	18.8	53,352	18.15	41,563	18.73	360.3	238.2
40040	MEAD	525	MEAD	19	34,097	19.62	24,519	20.73	34,357	20.28	25,164	21.37	259.9	644.2
9500	PALO VRD	525	PALO VRD	14	54,914	21.5	44,407	21.95	55,146	21.31	44,526	21.84	232.1	118.8
3229	HASSYMPA	525	HASSYMPA	14	53,462	24.37	43,229	25.97	53,629	24.2	43,312	25.88	166.9	82.7
92894	WESTWNGE	230	WESTWNG	14	30,056	23.77	28,367	24.82	30,184	23.62	28,475	24.75	128.3	107.7
40038	MEAD N.	230	MEAD N.	19	55,565	21.95	44,014	20.69	55,672	22.17	44,414	21.03	107.2	399.6
92012	AGUAFR	230	AGUAFR	14	43,083	12.55	30,759	12.23	43,177	12.51	30,802	12.21	94.1	42.9
3237	RED HAWK	525	RED HAWK	14	40,563	32.13	31,297	37.05	40,653	31.95	31,337	36.94	90.0	40.1
3242	RUDD	230	RUDD	14	51,367	14.08	31,364	12.1	51,454	14.04	31,392	12.09	86.6	28.2
10123	CRYSTAL	525	CRYSTAL	18	35,489	15.67	27,104	15.29	35,574	15.75	27,208	15.31	85.8	104.5
10124	CRST PST	525	CRST PST	18	35,343	15.87	26,990	15.52	35,428	15.95	27,093	15.55	85.0	103.3
16700	H ALLEN	525	H ALLEN	18	34,364	22.21	27,869	24.25	34,440	22.39	27,968	24.35	75.6	98.9
40037	MEAD S.	230	MEAD S.	19	62,936	18.86	52,646	16.1	63,011	18.95	52,782	16.18	75.0	135.8
1395	PPK NW	230	PPK NW	19	47,570	10.85	32,934	9.85	47,641	10.83	32,964	9.84	70.5	29.5
1398	PPK SW	230	PPK SW	19	47,652	10.84	32,998	9.84	47,723	10.82	33,028	9.83	70.5	29.4
2681	PPKSRW	230	PPKSRW	14	47,288	10.81	32,699	9.83	47,358	10.79	32,728	9.82	69.9	29.2
2668	PPKAPS	230	PPKAPS	14	47,492	10.87	32,865	9.88	47,562	10.85	32,894	9.87	69.7	29.1
2680	PPKSRE	230	PPKSRE	14	47,237	10.79	32,659	9.81	47,306	10.77	32,688	9.8	69.5	29.0
16639	MERCHANT	230	MERCHANT	18	59,850	20.12	48,761	19.5	59,918	20.22	48,885	19.59	68.1	123.4
2300	SURPRISE	230	SURPRISE	14	27,600	12.52	18,208	12.08	27,667	12.48	18,238	12.06	66.7	29.6
2285	EL SOL	230	EL SOL	14	34,296	12.64	22,705	11.97	34,362	12.61	22,732	11.96	65.3	26.8
18430	LENZIE	525	LENZIE	18	31,963	23.03	25,860	25.41	32,024	23.2	25,934	25.5	61.2	74.8
3232	ARLINGTN	525	ARLINGTN	14	32,604	41.68	24,046	49.83	32,662	41.46	24,070	49.69	58.1	23.6
2726	WHTNKAPS	230	WHTNKAPS	14	39,168	16.01	25,201	14.06	39,223	15.97	25,222	14.05	55.7	20.2
2460	LIBERTY	230	LIBERTY	19	43,298	11.2	27,955	10.38	43,351	11.18	27,976	10.37	53.4	20.6
2491	TS4	230	TS4	14	43,259	11.11	27,927	10.29	43,313	11.09	27,948	10.29	53.3	20.6
2258	DEERVALY	230	DEERVALY	14	27,205	11.36	18,402	10.79	27,257	11.33	18,424	10.77	52.4	21.9
9657	YAVAPAI	525	YAVAPAI	14	13,747	14.25	8,885	13.83	13,799	14.16	8,907	13.79	52.4	21.7
2462	LIBTYPS	230	LIBTYPS	19	42,664	11.37	27,519	10.55	42,716	11.35	27,539	10.54	51.8	20.0
98020	SOC	525	SOC	18	29,336	24.66	23,537	28.07	29,387	24.83	23,596	28.18	50.8	58.8

VII. SENSITIVITY STUDY RESULTS

With the SCE announcement regarding the Palo Verde-Devers#2 line, a sensitivity study was requested to adjust the EOR flow on the Post-Project Case B at 9,300MW accordingly and verify the impacts related to the HVSP without DPV2.

The analysis is based on the key assumption that the Path 49 power flow would be assessed at its maximum rating of 9,300 MW assuming the Harquahala-Devers 500 kV line will not be in service. The original DPV2 line has a planned rating of 1,200 MW.

A. Power Flow Analysis Results

The key finding from the power flow analysis is that the proposed generation project interconnection can achieve a reliable system performance in the Mead-Phoenix 500 kV line and non-simultaneous rating of Path 49 at 9,300 MW while meeting the thermal and voltage limits of the transmission system. The results show no negative impact to the interconnected transmission system.

The "Power Flow Diagrams of Base Cases and Contingency Cases" are provided in Appendix D-1. The "Power Flow Analysis Summary," which lists the highest transmission emergency loadings for critical contingency conditions, is provided in PF-Table 3 in the attachments of the report. The following provide highlights of the analysis.

- **No Impact on Perkins-Mead 500 kV Line**

The base case power flow measuring at the Perkins end was 1,692 MW (with a 760 MW injection). The flow was much higher at 2,381 MW when measuring at the other end at Mead. This should be considered to be acceptable from the base case power flow perspective.
From the system reliability viewpoint, the thermal loadings and bus voltages were within the criteria limits under base case and critical single contingency outage conditions.

- **No Impact on Path 49 EOR Rating**

Path 49 rating is not impacted by the looping of the Perkins - Mead 500 kV line through the proposed Hualapai Valley 500 kV Substation. As depicted from Tables PF-Table 3, the sensitivity of the EOR 9300 MW path rating without DPV2 line caused the flow to increase on the limiting facility, the Moenkopi-El Dorado 500 kV line, following the outage of Navajo - Crystal 500 kV line. The emergency loadings on the Moenkopi - El Dorado 500 kV line was increased from 96% to 99.2% of the its short-term rating with a 760 MW generation injection into the Perkins-Mead 500 kV line with Path 49 rating of 9,300 MW following the outage of Navajo – Crystal 500 kV line.

The following subsections provide highlights of the analysis:

1. The loading on the Moenkopi-Eldorado 500kV line series capacitors was increased to 99.2% of the emergency rating which was acceptable.

	Emergency Loading (%)		
Limiting Element	Post-ProjectB	Post-ProjectBS	Outage
Moenkopi-Eldorado Series Cap	96.0	99.2	NV-CR

2. The Liberty 230kV phase shifter was loaded more above or at 100% of its emergency for an outage of the Queue1-Mead 500kV line segment in the sensitivity case. The highest loadings are shown in the table below:

	Emergency Loading (%)		
Limiting Element	Post-ProjectB	Post-ProjectBS	Outage
Liberty 230kV Phase Shifter	102.9.0	105.0	Q1-MD

This overload problem can be resolved with the following mitigation alternatives:

Alternative 1: By-passing the Liberty 230kV phase shifty would eliminate the Liberty 230kV phase shifter overload problem. No other overloads were detected. The highest loadings were 93.6% on the Moenkopi-Eldorado 500kV line and 87.7% on the Liberty-Peacock 345 kV line, respectively.

By-Passed LBTY PST	Emergency Loading (%)		
Limiting Element	LBT PST I/S	LBT PST B/P	Outage
Moenkopi-Eldorado Series Cap	87.4	93.6	Q1-MD
Liberty-Peacock 345kV Line	93.4	87.7	Q1-MD

Alternative 2: Reducing a total of 610 MW of new project generation; the Hualapai Valley Solar Project generation 260 MW and High Queue generation 350 MW would overcome the Liberty 230kV phase shifter to its 100% of its emergency rating.

Reduced Project Generation	Emergency Loading (%)		
Limiting Element	No Reduction	W/ Reduction	Outage
Liberty 230kV Phase Shifter	105.0	100.0	Q1-MD

- **No Impact on Existing transmission System**

The local Hat WALC-Hassyamp 230kV line was loaded more above 100% of its emergency for an outage of the two Palo Verde-Westwing 500kV lines in the sensitivity case. The voltage profile of the existing transmission system was not impacted during normal and under contingency conditions.

The following subsections provide highlights of the analysis:

1. For the double line outage of the Palo Verde-Westwing 500 kV No. 1 and 2 lines in the post-project case and the sensitivity case, the highest loadings are shown in the table below: shown in the table below.

	Emergency Loading (%)		
Limiting Element	Post-ProjectB	Post-ProjectBS	Outage
Hat WALC-Hassyamp	107.0	110.8	PV-WW1&2

The "pre-existing" overload violation of the 5.93 mile 230 kV line would be resolved between Western and CAWCD with respect to CAWCD's requested 230 kV tie open between its Hassayampa Pumping Plant and APS' planned TS5 500/230 kV station. No other overloads were detected after a transfer trip of this local 230 kV tie.

B. Post-Transient Analysis

The key finding from the post-transient analysis is that the proposed generation project interconnection can achieve a reliable system performance in the Mead-Phoenix 500 kV line and non-simultaneous rating of Path 49, while meeting the post-transient voltage criteria limits of the transmission system. The results show no negative impact to the interconnected transmission system.

The "Post-Transient Power Flow Diagrams of Base Cases and Contingency Cases" are provided in Appendix B. Post-transient analysis was performed on selected critical outages (outage list is the same as power flow contingency list). The "Post-transient Analysis Summary," which lists the voltage performance levels for critical contingency conditions, is provided in PT-Table 3 in the attachment of the report. The following provides highlights of the analysis.

- The transmission system post-transient voltage deviations were within the 5% criteria limit for any N-1 contingencies with the interconnection of the proposed generation project(s) into the Perkins - Mead 500 kV line.

- The transmission system post-transient voltage deviations were within the 10% criteria limit for any N-2 contingencies with the interconnection of the proposed generation project(s) into the Perkins - Mead 500 kV line.

C. Transient Stability Analysis

The key finding from the transient stability analysis is that the proposed generation project interconnection can achieve a reliable system performance in the Mead-Phoenix 500 kV line and non-simultaneous rating of Path 49 while meeting the voltage dip, damping and frequency deviation limits of the transmission system. The results show no negative impact to the interconnected transmission system.

The "Transient Stability Plots" are provided in Appendix C. Transient stability analysis was performed on selected critical outages (outage list is the same as post-transient contingency list). The "Transient Stability Analysis Summary," which lists the dynamic stability performance levels for critical contingency conditions, is provided in TS-Table 3 in the attachment of the report. The following provides highlights of the analysis.

- Stable and adequately damped transient stability performances were achieved following all the outages simulated.

- No violation of WECC transient voltage dip criteria was found following all the outages simulated.

PF-TABLE 1: POWER FLOW RESULTS—PRE-PROJECT CASE C VS POST-PROJECTS CASE B

OUTAGES	LIMITING FACILITY	APPLICABLE RATING	PRE-PROJECT CASE C LOADING (%)	POST-PROJECT CASE B LOADING (%)	COMMENTS
CATEGORY B : LIMITING CONDITIONS					
PERKINS-MEAD 500 KV LINE (HIGH Q-MEAD 500kV LINE)	LIBERTY 230 KV PHASE SHIFTING TRANSFORMER	600 MVA	97	103	Slightly Exceeded the Emergency Limit
	LIBERTY 230 KV PHASE SHIFTING TRANSFORMER	600 MVA	97	99.9	Mitigated by backing down phase shifter angle 2 degrees
NAVAJO-CRYSTAL 500 KV LINE	MOENKOPI – ELDORDO 500 kV LINE	2750 A	96	96	None
CATEGORY C : LIMITING CONDITIONS					
TWO PALO VERDE-WESTWING 500 KV LINES	HASSYAMP - HAT-WALC 230 KV LINE	1012 A	111	107	Pre-existing Problem can be solved by transfer trip of TS5-Hassyamp line
PALOVRDE-DEVERS 500 kV & HARQUAHA-DEVERS 500 KV LINES	HASSYAMP - HAT-WALC 230 KV LINE	1012 A	106	108	Existing overload can be mitigated by using DPV2 proposed RAS
	PERKINS-WESTWING 500 KV LINE	3000 A	106	100	
	PERKINS – MEAD 500 KV LINE	2970 A	108	102	
	LIBERTY 230 KV PHASE SHIFTING TRANSFORMER	600 MVA	98	100	
	HASSYAMP-N.GILA 500 KV LINE	2970 A	93	97	

PF-TABLE 2: POWER FLOW RESULTS—PRE-PROJECT CASE C VS POST-PROJECTS CASE E

OUTAGES	LIMITING FACILITY	APPLICABLE RATING	PRE-PROJECT CASE C LOADING (%)	POST-PROJECT CASE B LOADING (%)	COMMENTS
CATEGORY B : LIMITING CONDITIONS					
PERKINS-MEAD 500 KV LINE (HIGH Q-MEAD 500kV LINE)	LIBERTY 230 KV PHASE SHIFTING TRANSFORMER	600 MVA	97	100	The Liberty 230 kV phase shifter reached the emergency Limit
NAVAJO-CRYSTAL 500 KV LINE	MOENKOPI – ELDORDO 500 kV LINE	2750 A	96	96	None
CATEGORY C : LIMITING CONDITIONS					
TWO PALO VERDE-WESTWING 500 KV LINES	HASSYAMP - HAT-WALC 230 KV LINE	1012 A	111	111	Pre-existing Problem can be solved by transfer trip of TS5-Hassyamp line
PALOVRDE-DEVERS 500 kV & HARQUAHA-DEVERS 500 KV LINES	HASSYAMP - HAT-WALC 230 KV LINE	1012 A	106	106	Existing overload will be mitigated by using DPV2 proposed RAS
	PERKINS-WESTWING 500 KV LINE	3000 A	106	106	
	PERKINS – MEAD 500 KV LINE	2970 A	108	107	
	LIBERTY 230 KV PHASE SHIFTING TRANSFORMER	600 MVA	98	98	
	HASSYAMP-N.GILA 500 KV LINE	2970 A	93	93	

PF-TABLE 3: POWER FLOW RESULTS—POST-PROJECT CASE B VS POST-PROJECTS CASE BS

OUTAGES	LIMITING FACILITY	APPLICABLE RATING	POST-PROJECT CASE B	POST-PROJECT CASE BS	COMMENTS
			LOADING (%)	LOADING (%)	
CATEGORY B : LIMITING CONDITIONS					
PERKINS-MEAD 500 KV LINE (HIGH Q-MEAD 500kV LINE)	LIBERTY 230 KV PHASE SHIFTING TRANSFORMER	600 MVA	103	105	Exceeded the Emergency Limit
	LIBERTY –PEACOCK 345 KV LINE	1148 A	84.5	87.5	Mitigated by bypassing Liberty phase shifter
NAVAJO-CRYSTAL 500 KV LINE	MOENKOPI – ELDORDO 500 kV LINE	2750 A	96	99.2	None
CATEGORY C : LIMITING CONDITIONS					
TWO PALO VERDE-WESTWING 500 KV LINES	HASSYAMP - HAT-WALC 230 KV LINE	1012 A	107	111	Pre-existing Problem can be solved by transfer trip of TS5-Hassyamp line
PALOVRDE-DEVERS 500 kV & HARQUAHA-DEVERS 500 KV LINES	HASSYAMP - HAT-WALC 230 KV LINE	1012 A	108	Not Applicable	Existing overload can be mitigated by using DPV2 proposed RAS
	PERKINS-WESTWING 500 KV LINE	3000 A	100	Not Applicable	
	PERKINS – MEAD 500 KV LINE	2970 A	102	Not Applicable	
	LIBERTY 230 KV PHASE SHIFTING TRANSFORMER	600 MVA	100	Not Applicable	
	HASSYAMP-N.GILA 500 KV LINE	2970 A	97	Not Applicable	

PT-TABLE 1: POST-TRANSIENT ANALYSIS--PRE-PROJECT CASE C VS POST-PROJECT CASE B

OUTAGE	PRE-PROJECT CASE C	POST-PROJECT CASE B
	BUS VOLTAGE DEVIATION	BUS VOLTAGE DEVIATION
CATEGORY B : LIMITING CONDITIONS		
PERKINS-MEAD 500 KV LINE	< 5%	N/A
PERKINS-HUALAPAI 500 KV LINE	N/A.	< 5%
HUALAPAI-HIGH QUEUE 500 KV LINE	N/A.	< 5%
HIGH QUEUE - MEAD 500 KV LINE	N/A.	< 5%
NAVAJO – CRYSTAL 500 KV LINE	< 5%	<5%
MOENKOPI-ELDORDO 500 KV LINE	< 5%	<5%
HASSYAMP-N. GILA 500 KV LINE	< 5%	<5%
PALO VERDE-DEVERS 500 KV LINE	< 5%	<5%
HARQUAHALA –DEVERS 500 KV LINE	< 5%	<5%
MEAD-MARKETPLACE 500 KV LINE	< 5%	<5%
MARKETPLACE – ADELANTO 500 KV LINE	< 5%	<5%
MARKETPLACE- MCCULLOUGH 500 KV LINE	< 5%	<5%
MCCULLOUGH – ELDORDO 500 KV LINE	< 5%	<5%
MCCULLOUGH – VICTORVL 500 KV LINE	< 5%	<5%
MCCULLOUGH - CRYSTAL 500 KV LINE	< 5%	<5%
ELDORDO – LUGO 500 KV LINE	< 5%	<5%
MOHAVE – LUGO 500 KV LINE	< 5%	<5%
VICTORVL – LUGO 500 KV LINE	< 5%	<5%
N. GILA – IMPERIAL VALLEY 500 KV LINE	< 5%	<5%
IMPERIAL VALLEY – MIGUEL 500 KV LINE	< 5%	<5%
ELDORDO – LUGO 500 KV LINE	< 5%	<5%
CATEGORY C : LIMITING CONDITIONS		
PALO VERDE- DEVERS & HARQUAHA – DEVERS 500 KV LINES	<10%	<10%
PALO VERDE – WESTWING #1 &2 500 KV LINES	<10%	<10%
IPPDC BIPOLE	<10%	<10%
CRYSTAL- MCCULOUGH & MEAD-HALLEN 500 KV LINES	<10%	<10%
CRYSTAL – MCCULOUGH #1 & 2 500 KV LINES	<10%	<10%
PALO VERDE G-2 LOSS	<10%	<10%

PT-TABLE 2: POST-TRANSIENT ANALYSIS--PRE-PROJECT CASE C VS POST-PROJECT CASE E

OUTAGE	PRE-PROJECT CASE C BUS VOLTAGE DEVIATION	POST-PROJECT CASE E BUS VOLTAGE DEVIATION
CATEGORY B : LIMITING CONDITIONS		
PERKINS-MEAD 500 KV LINE	< 5%	N/A
PERKINS-HUALAPAI 500 KV LINE	N/A.	< 5%
HUALAPAI-HIGH QUEUE 500 KV LINE	N/A.	< 5%
HIGH QUEUE - MEAD 500 KV LINE	N/A.	< 5%
NAVAJO – CRYSTAL 500 KV LINE	< 5%	<5%
MOENKOPI-ELDORDO 500 KV LINE	< 5%	<5%
HASSYAMP-N. GILA 500 KV LINE	< 5%	<5%
PALO VERDE-DEVERS 500 KV LINE	< 5%	<5%
HARQUAHALA –DEVERS 500 KV LINE	< 5%	<5%
MEAD-MARKETPLACE 500 KV LINE	< 5%	<5%
MARKETPLACE – ADELANTO 500 KV LINE	< 5%	<5%
MARKETPLACE- MCCULLOUGH 500 KV LINE	< 5%	<5%
MCCULLOUGH – ELDORDO 500 KV LINE	< 5%	<5%
MCCULLOUGH – VICTORVL 500 KV LINE	< 5%	<5%
MCCULLOUGH - CRYSTAL 500 KV LINE	< 5%	<5%
ELDORDO – LUGO 500 KV LINE	< 5%	<5%
MOHAVE – LUGO 500 KV LINE	< 5%	<5%
VICTORVL – LUGO 500 KV LINE	< 5%	<5%
N. GILA – IMPERIAL VALLEY 500 KV LINE	< 5%	<5%
IMPERIAL VALLEY – MIGUEL 500 KV LINE	< 5%	<5%
ELDORDO – LUGO 500 KV LINE	< 5%	<5%
CATEGORY C : LIMITING CONDITIONS		
PALO VERDE- DEVERS & HARQUAHA – DEVERS 500 KV LINES	<10%	<10%
PALO VERDE – WESTWING #1 &2 500 KV LINES	<10%	<10%
IPPDC BIPOLE	<10%	<10%
CRYSTAL- MCCULOUGH & MEAD-HALLEN 500 KV LINES	<10%	<10%
CRYSTAL – MCCULOUGH #1 & 2 500 KV LINES	<10%	<10%
PALO VERDE G-2 LOSS	<10%	<10%

PT-TABLE 3: POST-TRANSIENT ANALYSIS--POST-PROJECT CASE B VS POST-PROJECT CASE BS

OUTAGE	POST-PROJECT CASE B	POST-PROJECT CASE BS
	BUS VOLTAGE DEVIATION	BUS VOLTAGE DEVIATION
CATEGORY B : LIMITING CONDITIONS		
PERKINS-MEAD 500 KV LINE	N/A	N/A
PERKINS-HUALAPAI 500 KV LINE	< 5%	< 5%
HUALAPAI-HIGH QUEUE 500 KV LINE	< 5%	< 5%
HIGH QUEUE - MEAD 500 KV LINE	< 5%	< 5%
NAVAJO – CRYSTAL 500 KV LINE	< 5%	<5%
MOENKOPI-ELDORDO 500 KV LINE	< 5%	<5%
HASSYAMP-N. GILA 500 KV LINE	< 5%	<5%
PALO VERDE-DEVERS 500 KV LINE	< 5%	<5%
HARQUAHALA –DEVERS 500 KV LINE	< 5%	IMPRLVLY500=5.00% & MIGUEL500=5.02%
MEAD-MARKETPLACE 500 KV LINE	< 5%	<5%
MARKETPLACE – ADELANTO 500 KV LINE	< 5%	<5%
MARKETPLACE- MCCULLOUGH 500 KV LINE	< 5%	<5%
MCCULLOUGH – ELDORDO 500 KV LINE	< 5%	<5%
MCCULLOUGH – VICTORVL 500 KV LINE	< 5%	<5%
MCCULLOUGH - CRYSTAL 500 KV LINE	< 5%	<5%
ELDORDO – LUGO 500 KV LINE	< 5%	<5%
MOHAVE – LUGO 500 KV LINE	< 5%	<5%
VICTORVL – LUGO 500 KV LINE	< 5%	<5%
N. GILA – IMPERIAL VALLEY 500 KV LINE	< 5%	<5%
IMPERIAL VALLEY – MIGUEL 500 KV LINE	< 5%	<5%
ELDORDO – LUGO 500 KV LINE	< 5%	<5%
CATEGORY C : LIMITING CONDITIONS		
PALO VERDE- DEVERS & HARQUAHA – DEVERS 500 KV LINES	<10%	NOT APPLICABLE
PALO VERDE – WESTWING #1 &2 500 KV LINES	<10%	<10%
IPPDC BIPOLE	<10%	<10%
CRYSTAL- MCCULOUGH & MEAD-HALLEN 500 KV LINES	<10%	<10%
CRYSTAL – MCCULOUGH #1 & 2 500 KV LINES	<10%	<10%
PALO VERDE G-2 LOSS	<10%	<10%

TS-TABLE 1: TRANSIENT STABILITY ANALYSIS--PRE-PROJECT CASE C VS POST-PROJECT CASE B

OUTAGE	PRE-PROJECT CASE C			POST-PROJECT CASE B		
	VOLTAGE DIP CRITERIA VIOLATION	FREQUENCY CRITERIA VIOLATION	DAMPING	VOLTAGE DIP CRITERIA VIOLATION	FREQUENCY CRITERIA VIOLATION	DAMPING
CATEGORY B : LIMITING CONDITIONS						
PERKINS- MEAD 500 KV LINE	NO	NO	POSITIVE	N/A	N/A	N/A
PERKINS-HUALAPAI 500 KV LINE	N/A	N/A	N/A	NO	NO	POSITIVE
HIGH QUEUE-MEAD 500 KV LINE	N/A	N/A	N/A	NO	NO	POSITIVE
HASSYAMP-N. GILA 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE-DEVERS 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
HARQUAHALA-DEVERS 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
NAVAJO – CRYSTAL 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MOENKOPI-ELDORDO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MEAD-MARKETPLACE 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MARKETPL – ADELANTO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
CRYSTAL – MCCULLOUGH 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MCCULLOUGH – VICTORVL 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
ELDORDO – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MOHAVE – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
VICTORVL – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
CATEGORY C : LIMITING CONDITIONS						
PALO VERDE – WESTWING #1 &2 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE- DEVERS & HARQUAHA – DEVERS 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
MCCULLOUGH-VICTORVILLE #1 & 2 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
IPPDC BIPOLE	NO	NO	POSITIVE	NO	NO	POSITIVE
CRYSTAL-MCCULOUGH & MEAD-HALLEN 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE G-2 LOSS	NO	NO	POSITIVE	NO	NO	POSITIVE

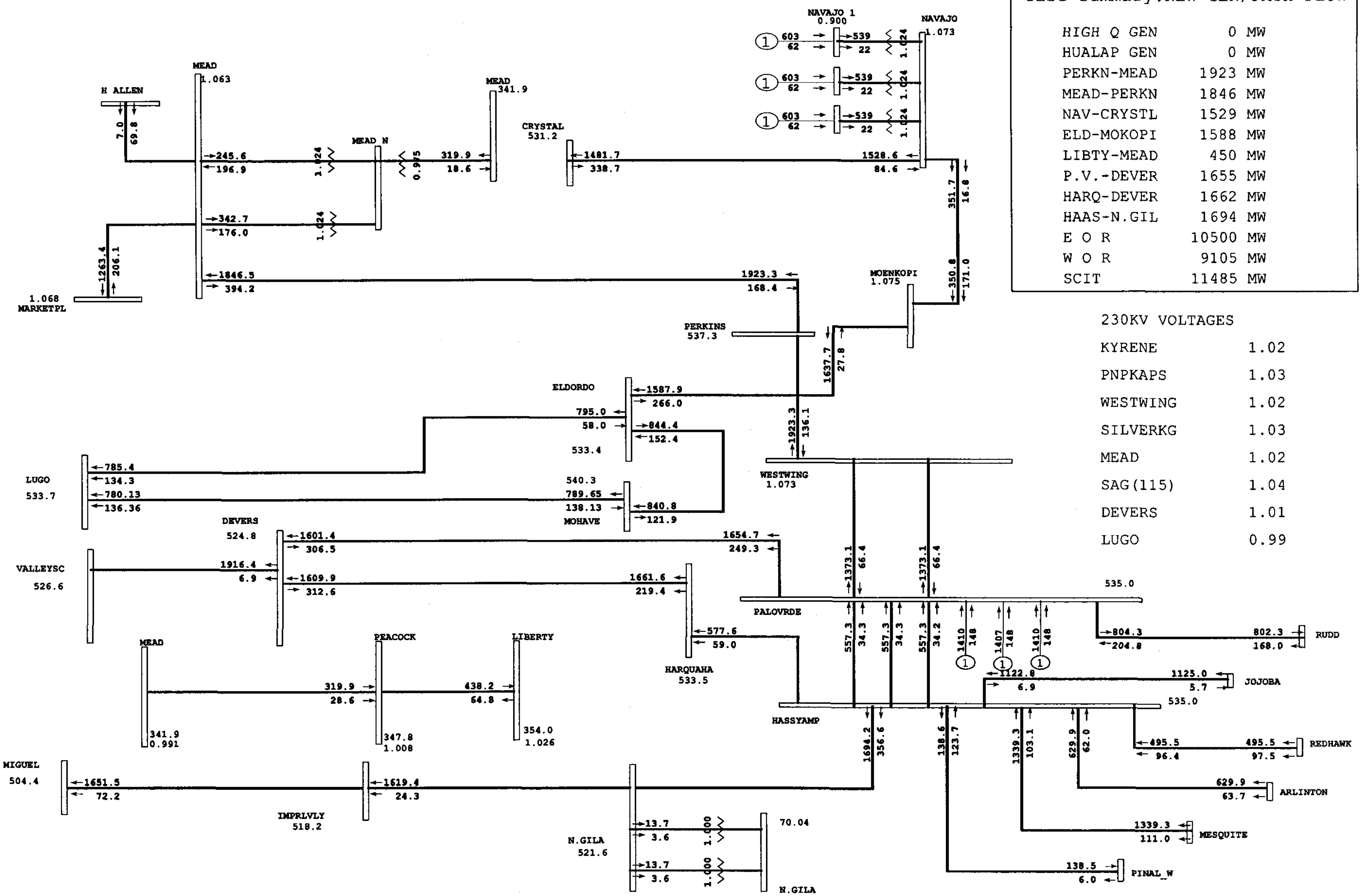
TS-TABLE 2: TRANSIENT STABILITY ANALYSIS--PRE-PROJECT CASE C VS POST-PROJECT CASE E

OUTAGE	PRE-PROJECT CASE C			POST-PROJECT CASE E		
	VOLTAGE DIP CRITERIA VIOLATION	FREQUENCY CRITERIA VIOLATION	DAMPING	VOLTAGE DIP CRITERIA VIOLATION	FREQUENCY CRITERIA VIOLATION	DAMPING
CATEGORY B : LIMITING CONDITIONS						
PERKINS- MEAD 500 KV LINE	NO	NO	POSITIVE	N/A	N/A	N/A
PERKINS-HUALAPAI 500 KV LINE	N/A	N/A	N/A	NO	NO	POSITIVE
HIGH QUEUE-MEAD 500 KV LINE	N/A	N/A	N/A	NO	NO	POSITIVE
HASSYAMP-N. GILA 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE-DEVERS 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
HARQUAHALA-DEVERS 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
NAVAJO – CRYSTAL 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MOENKOPI-ELDORDO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MEAD-MARKETPLACE 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MARKETPL – ADELANTO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
CRYSTAL – MCCULLOUGH 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MCCULLOUGH – VICTORVL 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
ELDORDO – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MOHAVE – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
VICTORVL – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
CATEGORY C : LIMITING CONDITIONS						
PALO VERDE – WESTWING #1 &2 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE- DEVERS & HARQUAHA – DEVERS 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
MCCULLOUGH-VICTORVILLE #1 & 2 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
IPPDC BIPOLE	NO	NO	POSITIVE	NO	NO	POSITIVE
CRYSTAL- MCCULOUGH & MEAD-HALLEN 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE G-2 LOSS	NO	NO	POSITIVE	NO	NO	POSITIVE

TS-TABLE 3: TRANSIENT STABILITY ANALYSIS--POST-PROJECT CASE B VS POST-PROJECT CASE BS

OUTAGE	POST-PROJECT CASE B			POST-PROJECT CASE BS		
	VOLTAGE DIP CRITERIA VIOLATION	FREQUENCY CRITERIA VIOLATION	DAMPING	VOLTAGE DIP CRITERIA VIOLATION	FREQUENCY CRITERIA VIOLATION	DAMPING
CATEGORY B : LIMITING CONDITIONS						
PERKINS- MEAD 500 KV LINE	N/A	N/A	N/A	N/A	N/A	N/A
PERKINS-HUALAPAI 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
HIGH QUEUE-MEAD 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
HASSYAMP-N. GILA 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE-DEVERS 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
HARQUAHALA-DEVERS 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
NAVAJO – CRYSTAL 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MOENKOPI-ELDORDO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MEAD-MARKETPLACE 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MARKETPL – ADELANTO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
CRYSTAL – MCCULLOUGH 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MCCULLOUGH – VICTORVL 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
ELDORDO – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
MOHAVE – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
VICTORVL – LUGO 500 KV LINE	NO	NO	POSITIVE	NO	NO	POSITIVE
CATEGORY C : LIMITING CONDITIONS						
PALO VERDE – WESTWING #1 &2 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE- DEVERS & HARQUAHA – DEVERS 500 KV LINES	NO	NO	POSITIVE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
MCCULLOUGH-VICTORVILLE #1 & 2 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
IPPDC BIPOLE	NO	NO	POSITIVE	NO	NO	POSITIVE
CRYSTAL-MCCULOUGH & MEAD-HALLEN 500 KV LINES	NO	NO	POSITIVE	NO	NO	POSITIVE
PALO VERDE G-2 LOSS	NO	NO	POSITIVE	NO	NO	POSITIVE

WESTERN ARIZONA AREA TRANSMISSION SYSTEM MAP



Case Summary:NEW GEN/PATH FLOW		
HIGH Q GEN	0	MW
HUALAP GEN	0	MW
PERKN-MEAD	1923	MW
MEAD-PERKN	1846	MW
NAV-CRYSTL	1529	MW
ELD-MOKOPI	1588	MW
LIBTY-MEAD	450	MW
P.V.-DEVER	1655	MW
HARQ-DEVER	1662	MW
HAAS-N.GIL	1694	MW
E O R	10500	MW
W O R	9105	MW
SCIT	11485	MW

230KV VOLTAGES	
KYRENE	1.02
PNPKAPS	1.03
WESTWING	1.02
SILVERKG	1.03
MEAD	1.02
SAG(115)	1.04
DEVERS	1.01
LUGO	0.99

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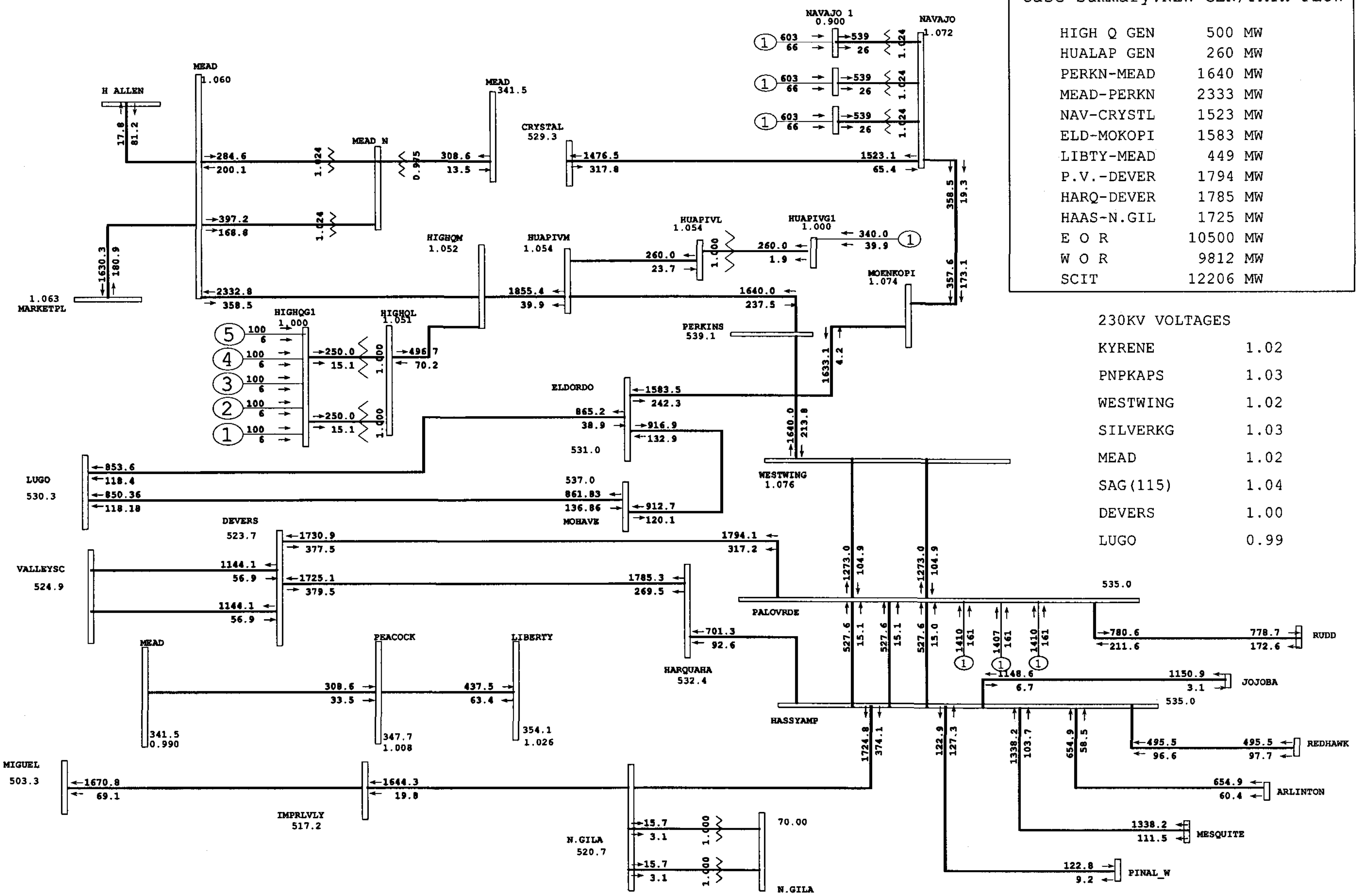
13HA-PREC00:PRE-HUALA SOLAR AND PRE-HIGH QUEUE PROJECT
NO HUALAPAI SOLAR AND NO HIGH QUEUE PROJECTS WERE ON-LINE
TODAY'S TRANSMISSION CONFIGURATION FOR MAX EOR & MPP RATINGS

EOR=10,500 MW,PERKINS-MEAD=1,923 MW @PERKINS & 1847MW@ MEAD
PRE-PROJECT BENCHMARK CASE (4/06/09)

MW/MVAR
hualapai2.drw
Rating = 1

WESTERN ARIZONA AREA TRANSMISSION SYSTEM MAP



Case Summary:NEW GEN/PATH FLOW

HIGH Q GEN	500	MW
HUALAP GEN	260	MW
PERKN-MEAD	1640	MW
MEAD-PERKN	2333	MW
NAV-CRYSTL	1523	MW
ELD-MOKOPI	1583	MW
LIBTY-MEAD	449	MW
P.V.-DEVER	1794	MW
HARQ-DEVER	1785	MW
HAAS-N.GIL	1725	MW
E O R	10500	MW
W O R	9812	MW
SCIT	12206	MW

230KV VOLTAGES

KYRENE	1.02
PNPKAPS	1.03
WESTWING	1.02
SILVERKG	1.03
MEAD	1.02
SAG(115)	1.04
DEVERS	1.00
LUGO	0.99

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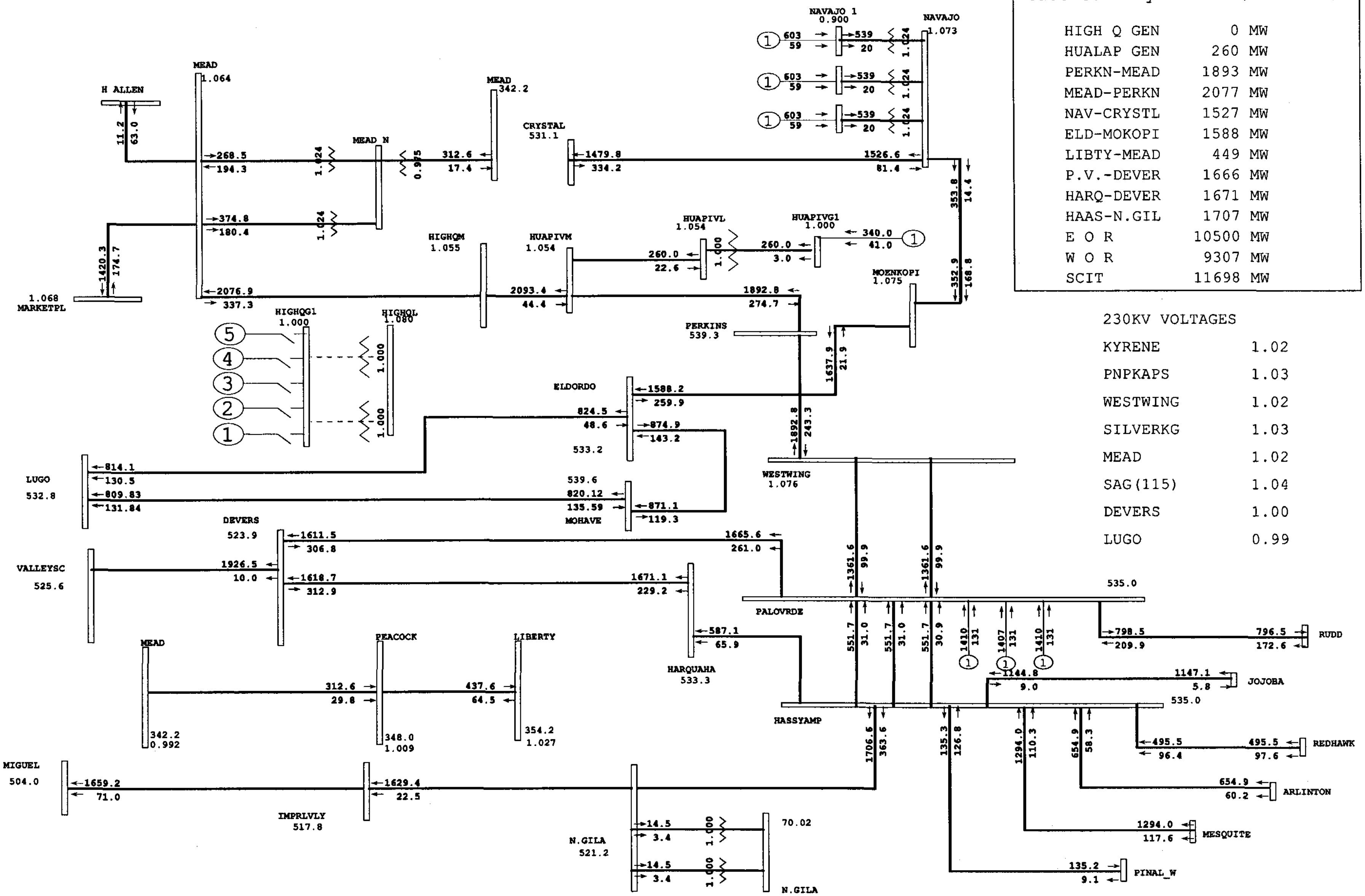
13HA-POST CASE B: POST-PROJECT SCENARION B BASE CASE WITH 760 MW TO CA
HUALAPAI SOLAR PROJECT AND HIGH QUEUE PROJECTS WERE ON-LINE
EOR=10500MW,PERKINS-MEAD=1640 MW METERED@PERKIN & 2333 MW METERED@MEAD

PATH 49 EOR AND 63 MPP USED THE EXISITNG METERING POINT
POST -PROJECT SCENARION CASE B (4/13/09)

MW/MVAR
hualapai.drw
Rating = 1

WESTERN ARIZONA AREA TRANSMISSION SYSTEM MAP



Case Summary:NEW GEN/PATH FLOW

HIGH Q GEN	0	MW
HUALAP GEN	260	MW
PERKN-MEAD	1893	MW
MEAD-PERKN	2077	MW
NAV-CRYSTL	1527	MW
ELD-MOKOPI	1588	MW
LIBTY-MEAD	449	MW
P.V.-DEVER	1666	MW
HARQ-DEVER	1671	MW
HAAS-N.GIL	1707	MW
E O R	10500	MW
W O R	9307	MW
SCIT	11698	MW

230KV VOLTAGES

KYRENE	1.02
PNPKAPS	1.03
WESTWING	1.02
SILVERKG	1.03
MEAD	1.02
SAG(115)	1.04
DEVERS	1.00
LUGO	0.99

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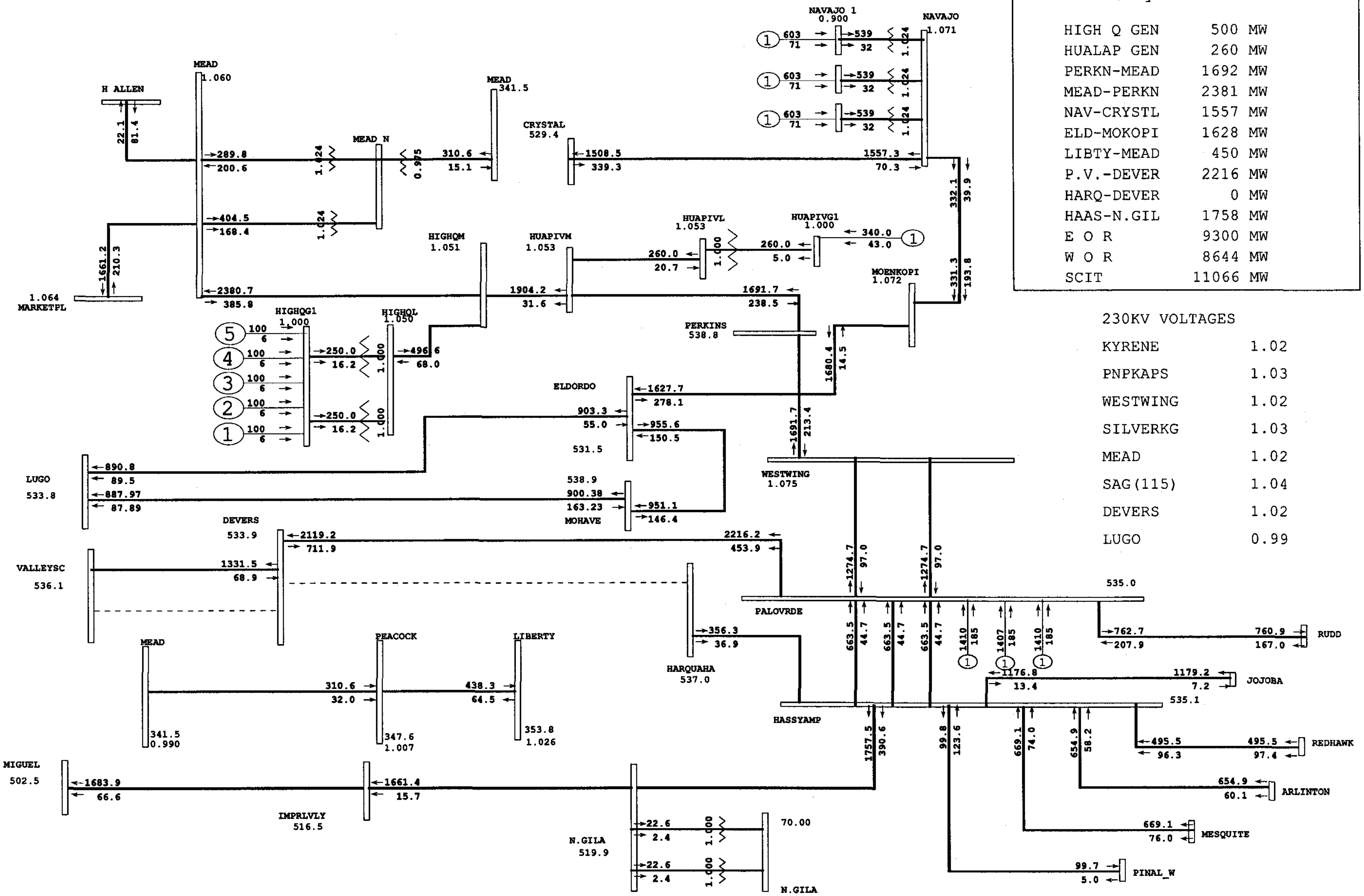
13HA-POST CASE E: POST-PROJECT SCENARIO E BASE CASE WITH 260 MW TO CA
HUALAPAI SOLAR PROJECT TURNED ON AND NO HIGH QUEUE PROJECTS WERE MODELED
EOR=10500MW,PERKINS-MEAD=1893MW METERED @PERKINS &@ 2077MW METERED @MEAD

PATH 49 EOR AND 63 MPP USED THE EXISITNG METERING POINT
POST -PROJECT SCENARION CASE E (4/06/09)

MW/MVAR
hualapai.drw
Rating = 1

WESTERN ARIZONA AREA TRANSMISSION SYSTEM MAP



Case Summary:NEW GEN/PATH FLOW	
HIGH Q GEN	500 MW
HUALAP GEN	260 MW
PERKN-MEAD	1692 MW
MEAD-PERKN	2381 MW
NAV-CRYSTL	1557 MW
ELD-MOKOPI	1628 MW
LIBTY-MEAD	450 MW
P.V.-DEVER	2216 MW
HARQ-DEVER	0 MW
HAAS-N.GIL	1758 MW
E O R	9300 MW
W O R	8644 MW
SCIT	11066 MW

230KV VOLTAGES	
KYRENE	1.02
PNPKAPS	1.03
WESTWING	1.02
SILVERKG	1.03
MEAD	1.02
SAG(115)	1.04
DEVERS	1.02
LUGO	0.99

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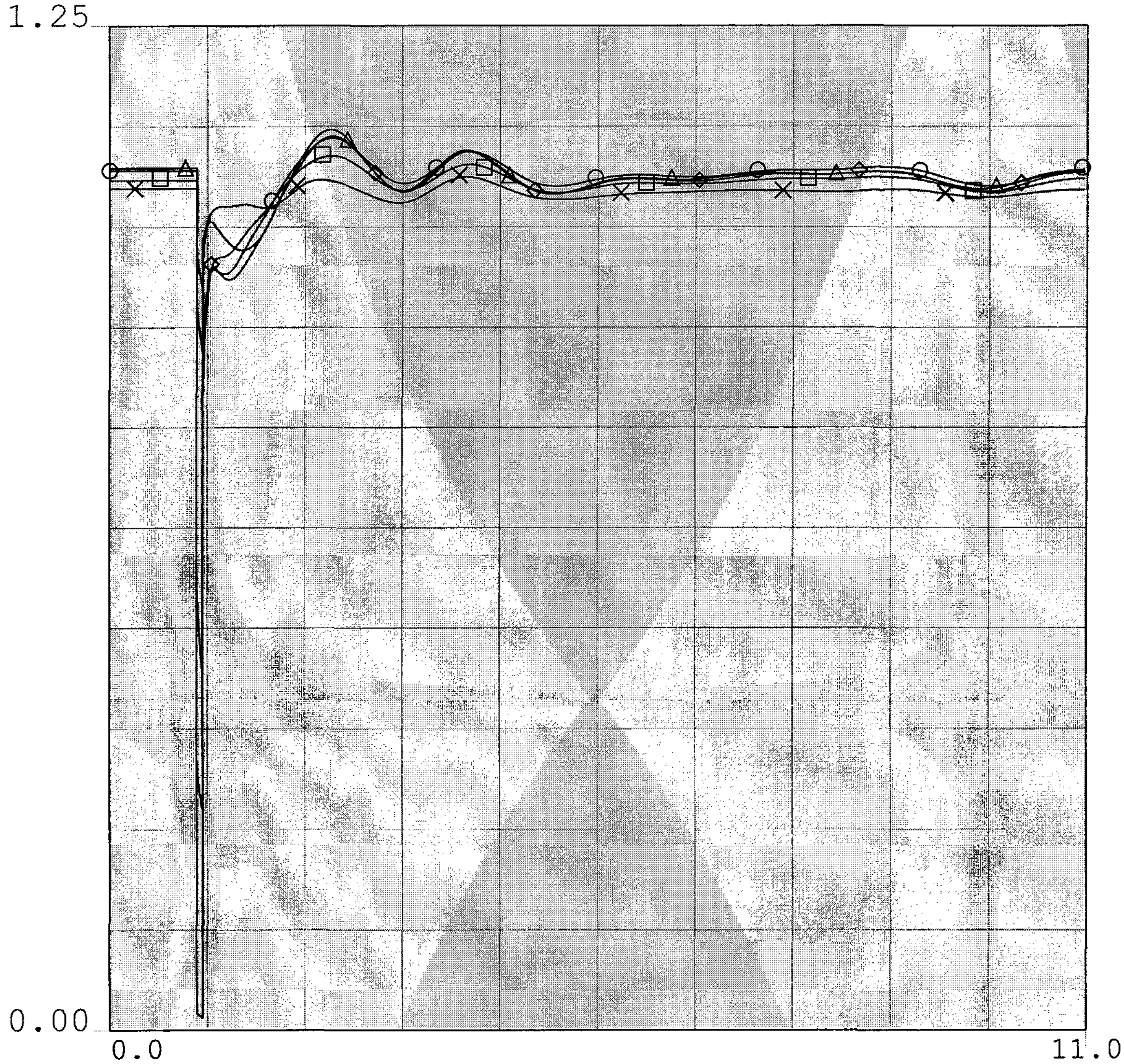
13HA-POST CASE B1S: POST-PROJECT SCENARION B BASE CASE WITH 760 MW TO CA
HUALAPAI SOLAR PROJECT AND HIGH QUEUE PROJECTS WERE ON-LINE
EOR=9300MW,PERKINS-MEAD=1692MW METERED@PERKIN & 2381MW METERED@MEAD

PATH 49 EOR AND 63 MPP USED THE EXISITNG METERING POINT
POST -PROJECT SCENARION CASE B (06/03/09)

MW/MVAR
hualapai.drw
Rating = 1

ARIZONA_voltages:



0.0000	vbus	15021	PALOVRDE 500.0	0	0.0	1	1	1.2500
0.0000	vbus	14001	FOURCORN 500.0	0	0.0	1	1	1.2500
0.0000	vbus	15011	KYRENE 500.0	0	0.0	1	1	1.2500
0.0000	vbus	14003	NAVAJO 500.0	0	0.0	1	1	1.2500
0.0000	vbus	14005	WESTWING 500.0	0	0.0	1	1	1.2500

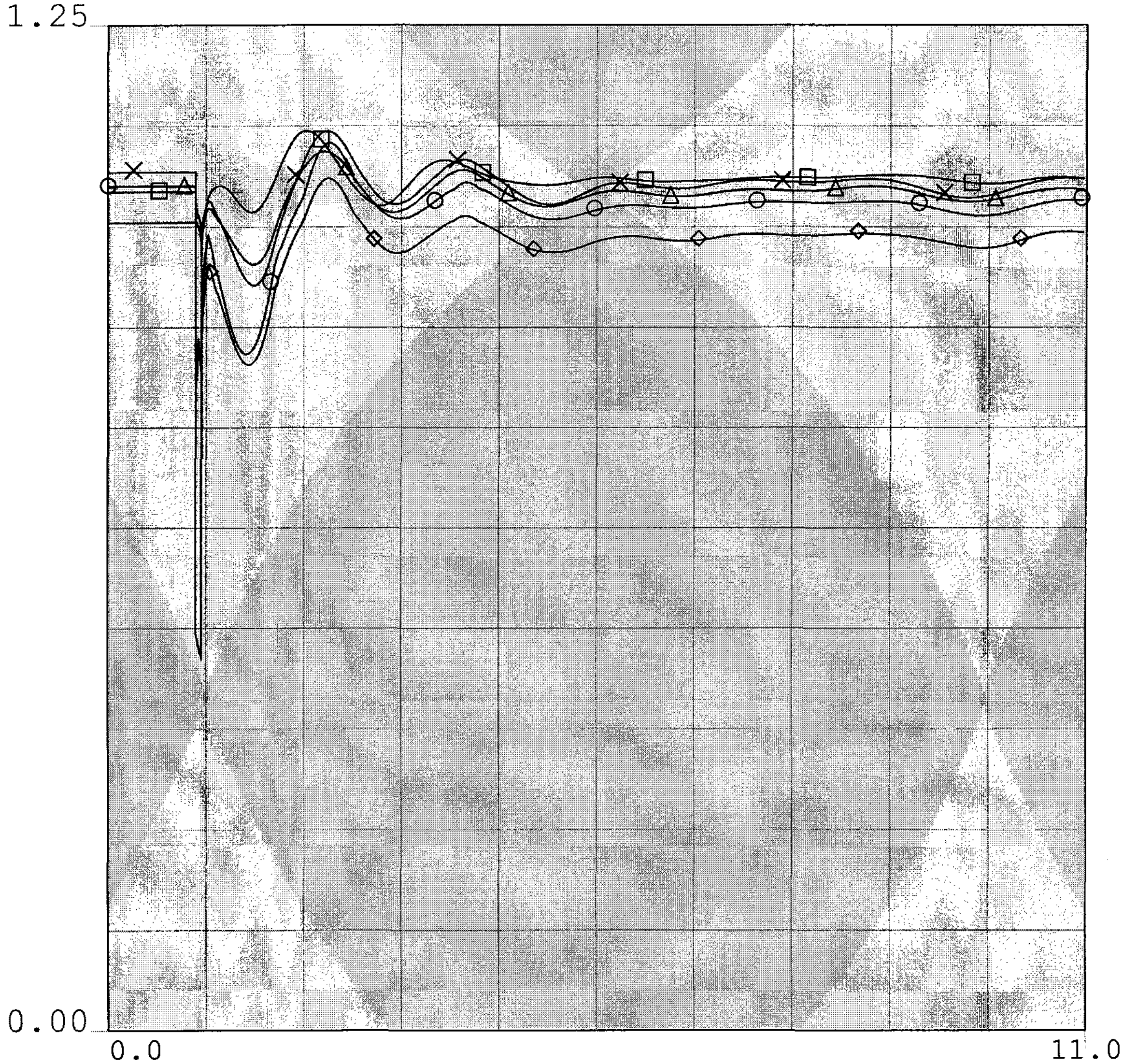
13HANONSIM105001PRE3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, WITH PRE-PROJECT TRANSMISSION SYSTEM

13ha-nspre3.chf

c:\upslf163\mypslf\stab

Thu May 07 05:36:27 2009

CALIFORNIA_voltages:

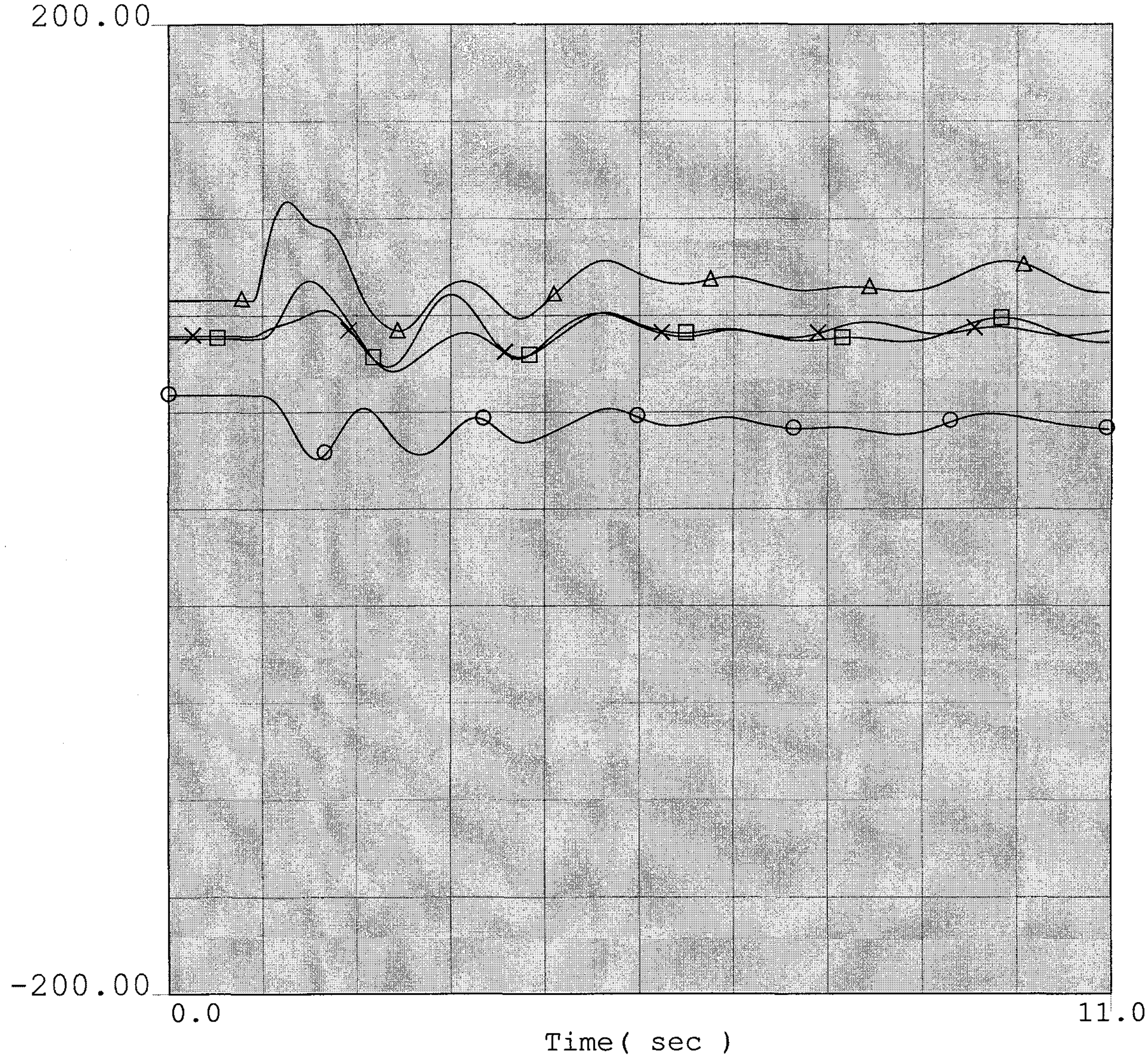


○	0.0000	vbus	24801	DEVERS 500.0	0	0.0	1	1	1.2500
×	0.0000	vbus	24086	LUGO 500.0	0	0.0	1	1	1.2500
□	0.0000	vbus	22536	N.GILA 500.0	0	0.0	1	1	1.2500
△	0.0000	vbus	26094	SYLMARLA 230.0	0	0.0	1	1	1.2500
◇	0.0000	vbus	24804	DEVERS 230.0	0	0.0	1	1	1.2500

13HANONSIM105001PRE3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, WITH PRE-PROJECT TRANSMISSION SYSTEM

	13ha-nspre3.chf	c:\upslf163\mypslf\stab Thu May 07 05:36:28 2009

SYSTEM_Rotorangles



-200.0000 ang	24129	S.ONOFR2	22.0	0	0.0	1	1	200.0000
-200.0000 ang	26039	INTERM1G	26.0	0	0.0	1	1	200.0000
-200.0000 ang	15981	NAVAJO 1	26.0	0	0.0	1	1	200.0000
-200.0000 ang	14931	PALOVRD1	24.0	0	0.0	1	1	200.0000
-200.0000 ang	14095		0.0	0	0.0	1		200.0000

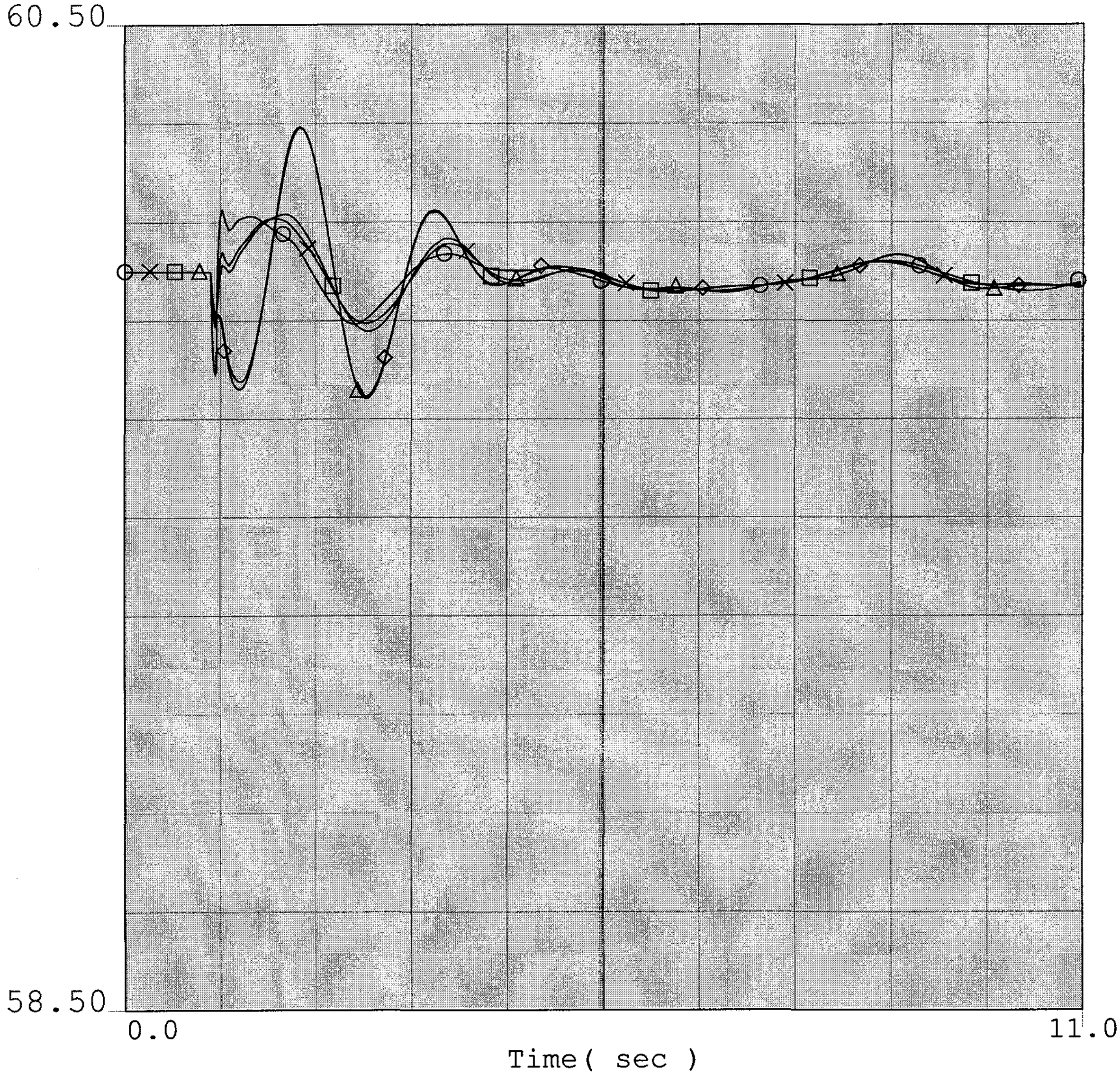
13HANONSIM105001PRE3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, WITH PRE-PROJECT TRANSMISSION SYSTEM

13ha-nspre3.chf

c:\upslf163\mypslf\stab

Thu May 07 05:36:30 2009

Frequencies:



○	58.5000 fbus	24801	DEVERS 500.0	0	0.0	1	1	60.5000
×	58.5000 fbus	24086	LUGO 500.0	0	0.0	1	1	60.5000
□	58.5000 fbus	26094	SYLMARLA 230.0	0	0.0	1	1	60.5000
△	58.5000 fbus	22468	MIGUEL 500.0	0	0.0	1	1	60.5000
◇	58.5000 fbus	22536	N.GILA 500.0	0	0.0	1	1	60.5000

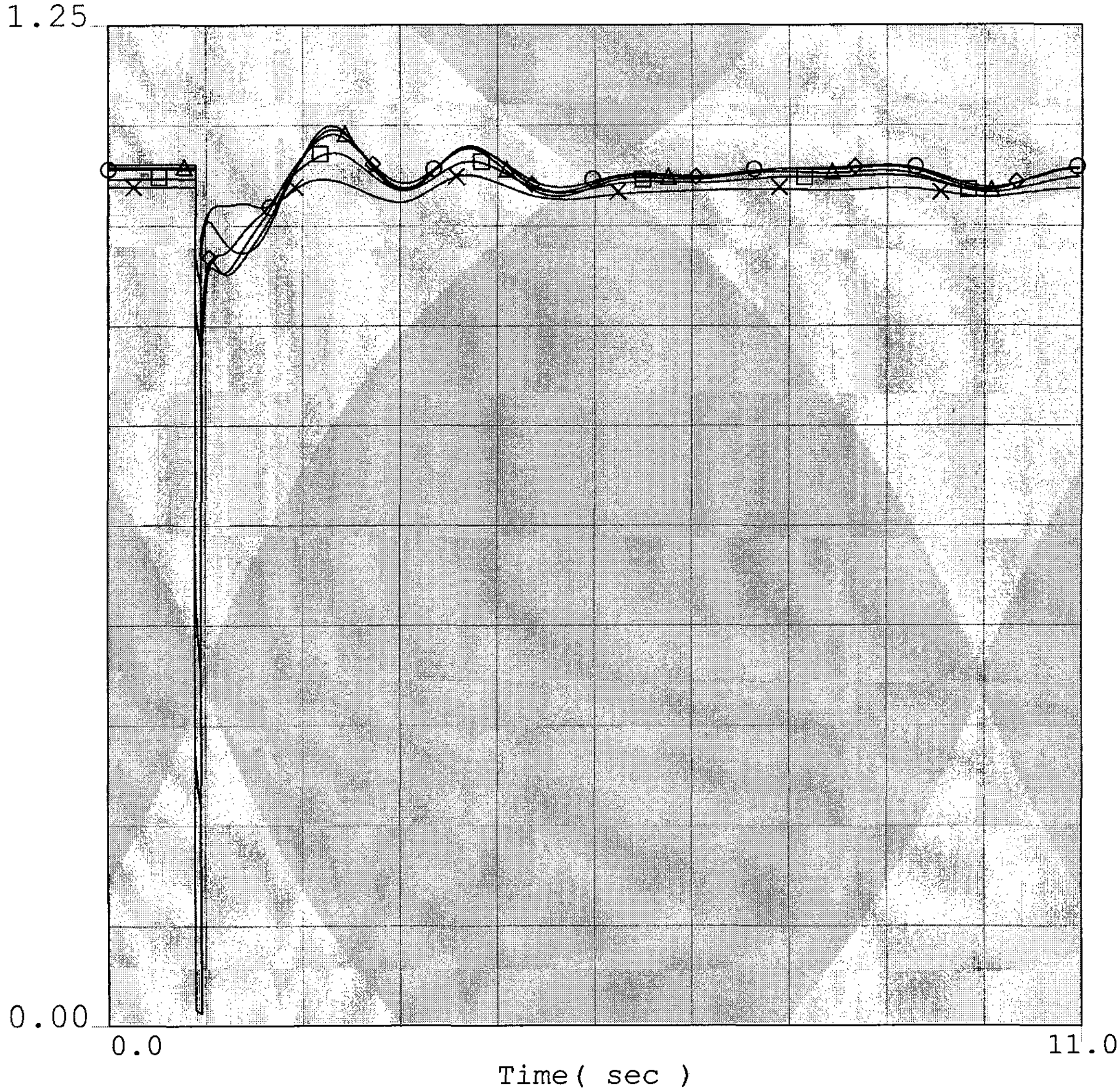
13HANONSIM105001PRE3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, WITH PRE-PROJECT TRANSMISSION SYSTEM

13ha-nspre3.chf

c:\upslf163\mypslf\stab

Thu May 07 05:36:30 2009

ARIZONA_voltages:



○	0.0000	vbus	15021	PALOVRDE 500.0	0	0.0	1	1	1.2500
×	0.0000	vbus	14001	FOURCORN 500.0	0	0.0	1	1	1.2500
□	0.0000	vbus	15011	KYRENE 500.0	0	0.0	1	1	1.2500
△	0.0000	vbus	14003	NAVAJO 500.0	0	0.0	1	1	1.2500
◇	0.0000	vbus	14005	WESTWING 500.0	0	0.0	1	1	1.2500

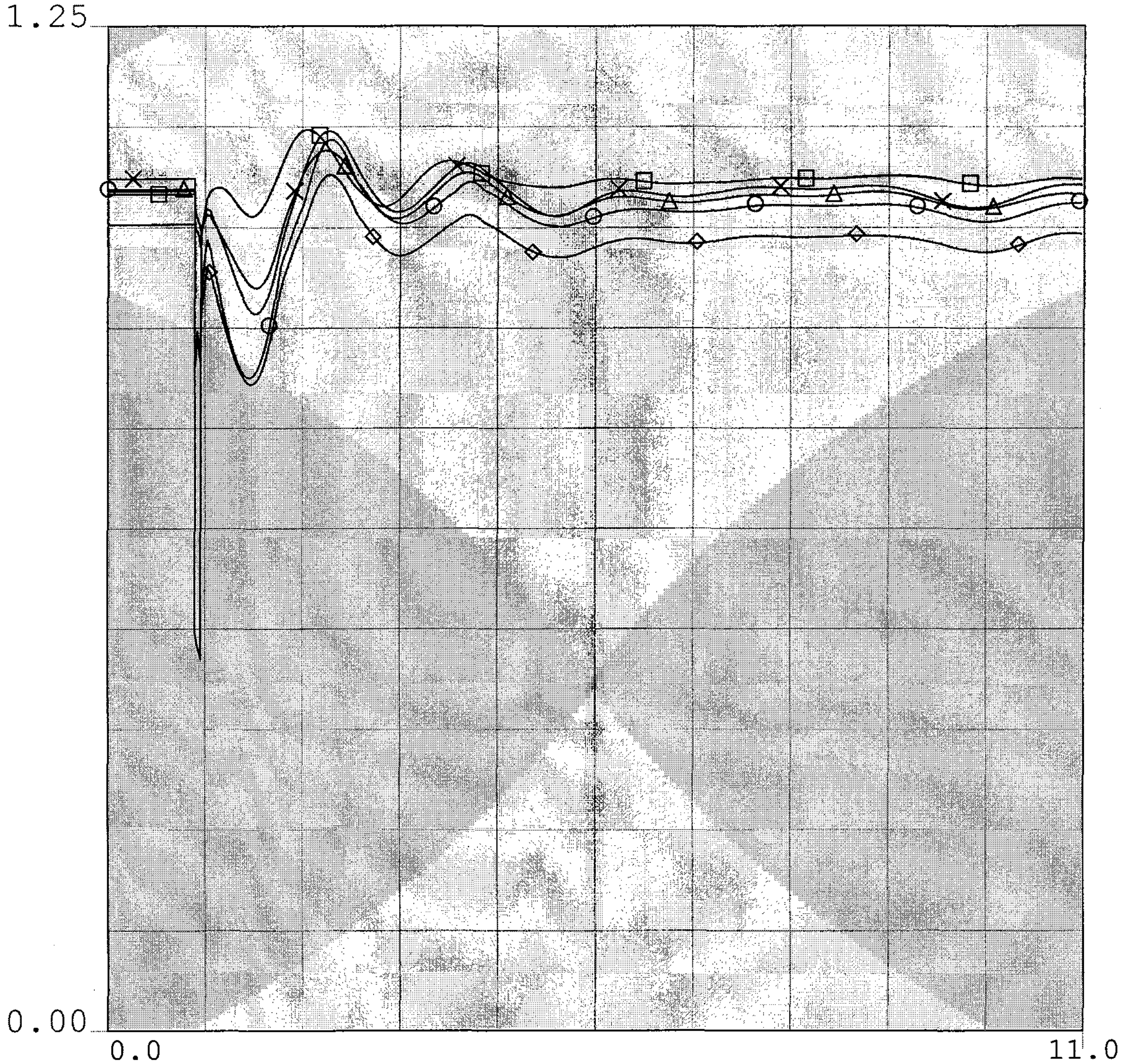
13HA105001B3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3.chf

c:\upslf163\mypslf\stab

Mon May 04 09:30:19 2009

CALIFORNIA_voltages:



○	0.0000	vbus	24801	DEVERS 500.0	0	0.0	1	1	1.2500
×	0.0000	vbus	24086	LUGO 500.0	0	0.0	1	1	1.2500
□	0.0000	vbus	22536	N.GILA 500.0	0	0.0	1	1	1.2500
△	0.0000	vbus	26094	SYLMARLA 230.0	0	0.0	1	1	1.2500
◇	0.0000	vbus	24804	DEVERS 230.0	0	0.0	1	1	1.2500

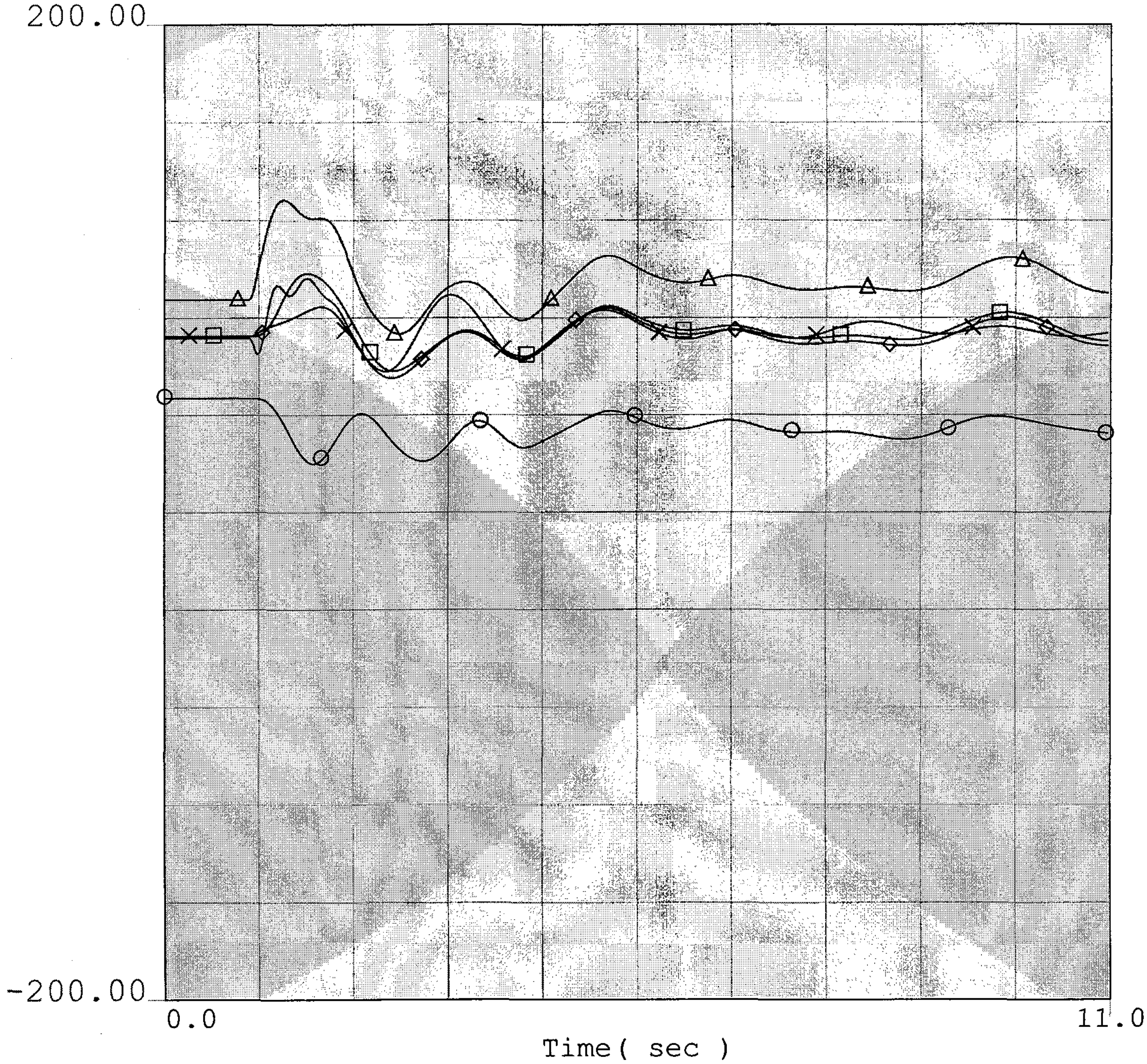
13HA105001B3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3.chf

c:\upslf163\mypslf\stab

Mon May 04 09:30:19 2009

SYSTEM_Rotorangles



○	-200.0000	ang	24129	S.ONOFR2	22.0	0	0.0	1	1	200.0000
X	-200.0000	ang	26039	INTERM1G	26.0	0	0.0	1	1	200.0000
□	-200.0000	ang	15981	NAVAJO 1	26.0	0	0.0	1	1	200.0000
△	-200.0000	ang	14931	PALOVRD1	24.0	0	0.0	1	1	200.0000
◇	-200.0000	ang	14095	HUAPIVG1	21.0	0	0.0	1	1	200.0000

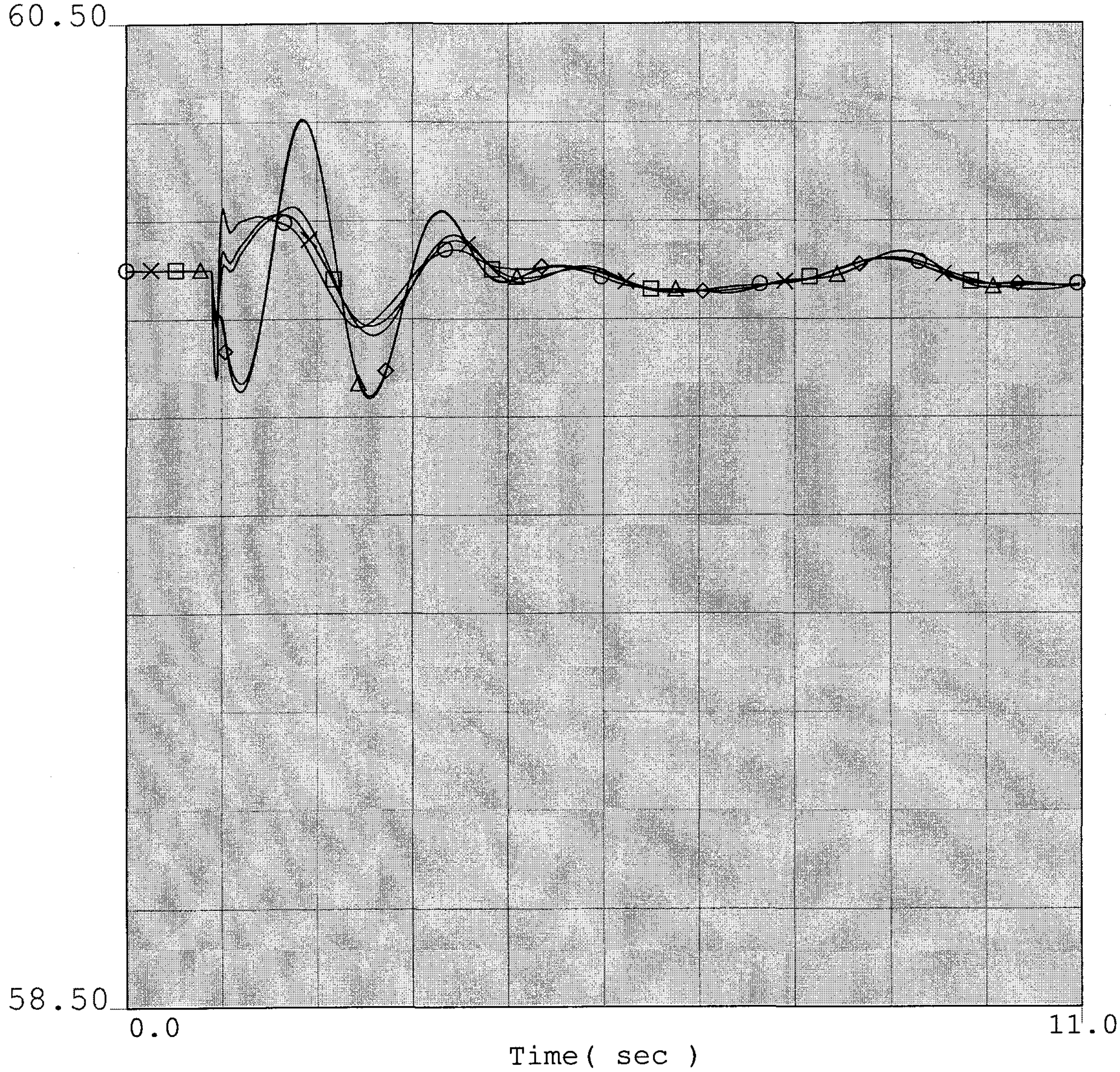
13HA105001B3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3.chf

c:\upslf163\mypslf\stab

Mon May 04 09:30:21 2009

Frequencies:



58.5000	fbus	24801	DEVERS 500.0	0	0.0	1	1	60.5000
58.5000	fbus	24086	LUGO 500.0	0	0.0	1	1	60.5000
58.5000	fbus	26094	SYLMARLA 230.0	0	0.0	1	1	60.5000
58.5000	fbus	22468	MIGUEL 500.0	0	0.0	1	1	60.5000
58.5000	fbus	22536	N.GILA 500.0	0	0.0	1	1	60.5000

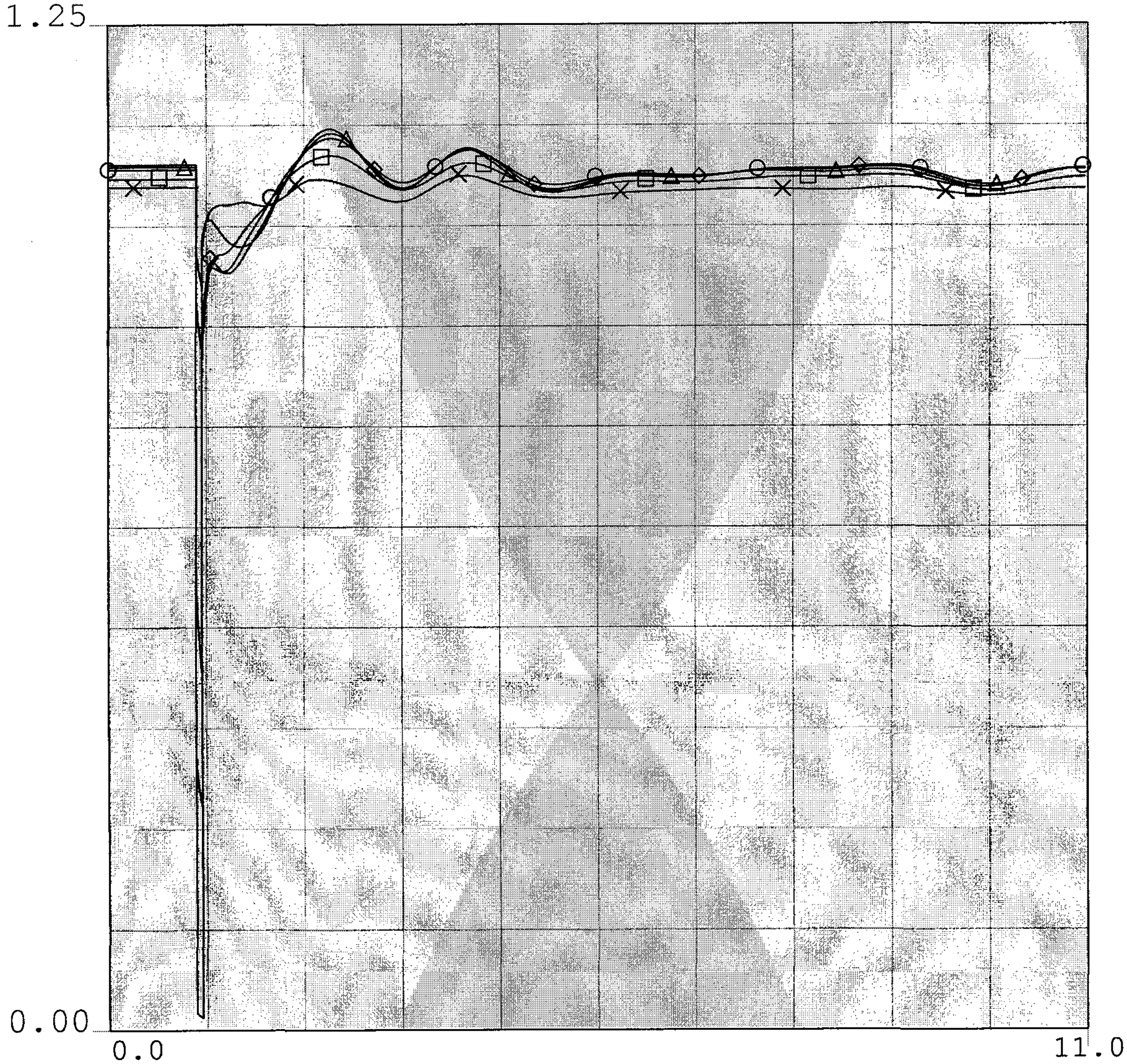
13HA105001B3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3.chf

c:\upslf163\mypslf\stab

Mon May 04 09:30:21 2009

ARIZONA_voltages:



○	0.0000 vbus	15021	PALOVRDE 500.0	0	0.0	1	1	1.2500
×	0.0000 vbus	14001	FOURCORN 500.0	0	0.0	1	1	1.2500
□	0.0000 vbus	15011	KYRENE 500.0	0	0.0	1	1	1.2500
△	0.0000 vbus	14003	NAVAJO 500.0	0	0.0	1	1	1.2500
◇	0.0000 vbus	14005	WESTWING 500.0	0	0.0	1	1	1.2500

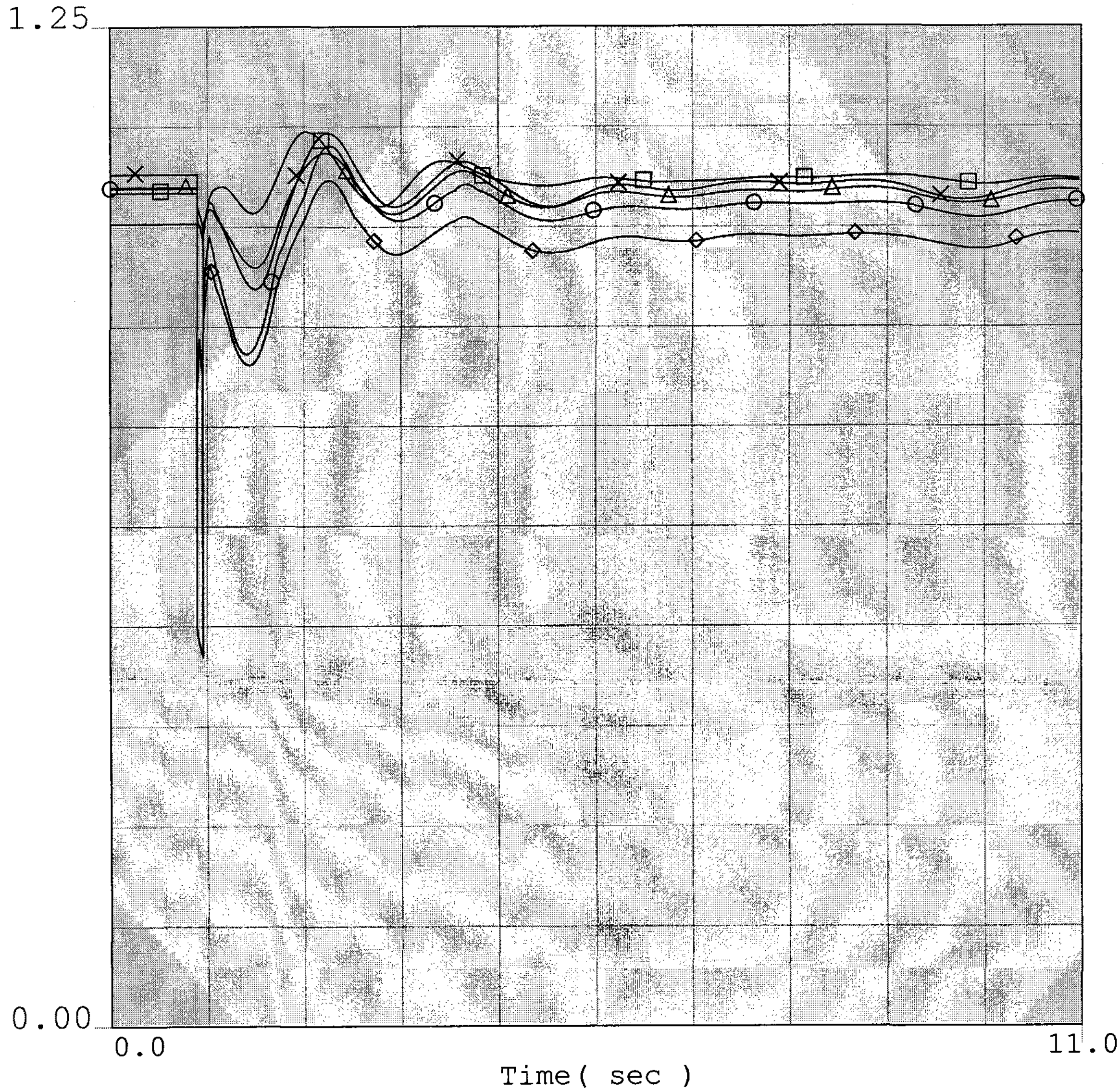
13HA-POST CASE E: POST-PROJECT SCENARIO E BASE CASE WITH 260 MW TO CA
HUALAPAI SOLAR PROJECT TURNED ON AND NO HIGH QUEUE PROJECTS WERE MODELED
EOR=10500MW,PERKINS-MEAD=1893MW METERED @PERKINS &@ 2077MW METERED @MEAD
13HA105001E3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT,WITH HUALAPAI SOLAR PROJECT EXPORTING 260 MW

13ha-ns1e3.chf

c:\upslf163\mypslf\stab

Tue May 05 08:43:07 2009

CALIFORNIA_voltages:



0.0000	vbus	24801	DEVERS 500.0	0	0.0	1	1	1.2500
0.0000	vbus	24086	LUGO 500.0	0	0.0	1	1	1.2500
0.0000	vbus	22536	N.GILA 500.0	0	0.0	1	1	1.2500
0.0000	vbus	26094	SYLMARLA 230.0	0	0.0	1	1	1.2500
0.0000	vbus	24804	DEVERS 230.0	0	0.0	1	1	1.2500

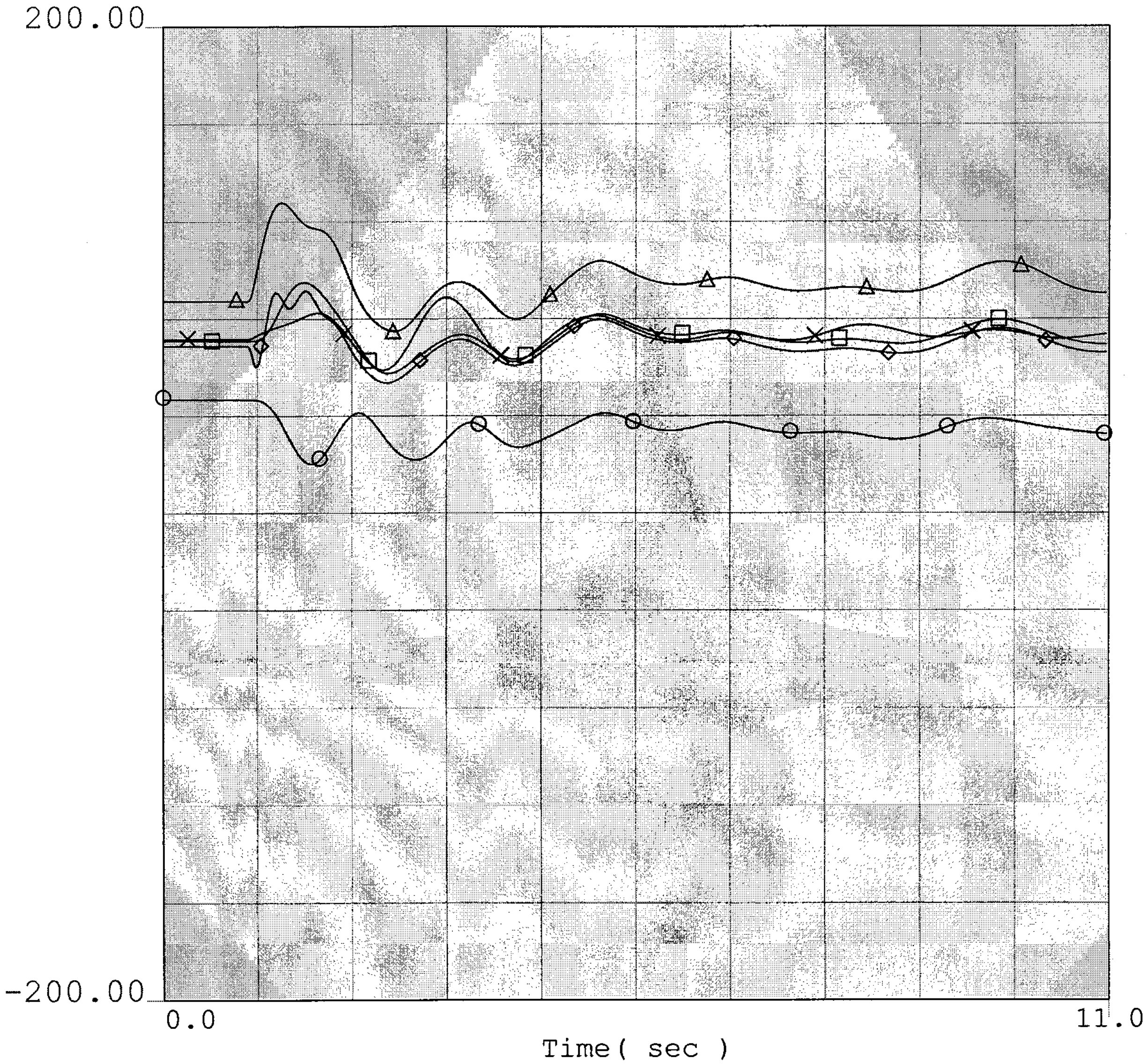
13HA-POST CASE E: POST-PROJECT SCENARIO E BASE CASE WITH 260 MW TO CA
HUALAPAI SOLAR PROJECT TURNED ON AND NO HIGH QUEUE PROJECTS WERE MODELED
EOR=10500MW,PERKINS-MEAD=1893MW METERED @PERKINS &@ 2077MW METERED @MEAD
13HA105001E3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT,WITH HUALAPAI SOLAR PROJECT EXPORTING 260 MW

13ha-ns1e3.chf

c:\upslf163\mypslf\stab

Tue May 05 08:43:07 2009

SYSTEM_Rotorangles



○	-200.0000 ang	24129	S.ONOFR2	22.0	0	0.0	1	1	200.0000
X	-200.0000 ang	26039	INTERM1G	26.0	0	0.0	1	1	200.0000
□	-200.0000 ang	15981	NAVAJO 1	26.0	0	0.0	1	1	200.0000
△	-200.0000 ang	14931	PALOVRD1	24.0	0	0.0	1	1	200.0000
◇	-200.0000 ang	14095	HUAPIVG1	21.0	0	0.0	1	1	200.0000

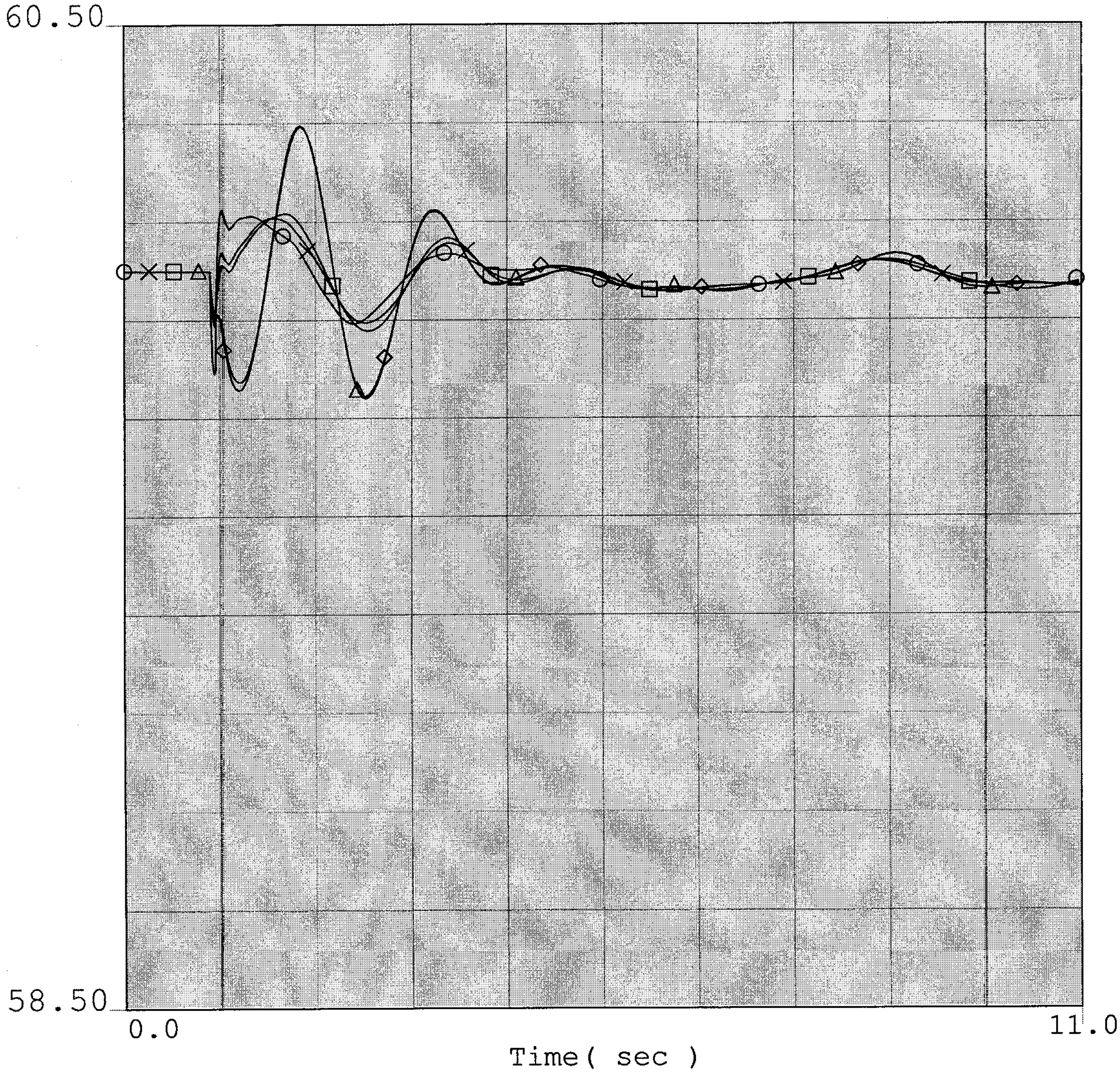
13HA-POST CASE E: POST-PROJECT SCENARIO E BASE CASE WITH 260 MW TO CA
HUALAPAI SOLAR PROJECT TURNED ON AND NO HIGH QUEUE PROJECTS WERE MODELED
EOR=10500MW,PERKINS-MEAD=1893MW METERED @PERKINS &@ 2077MW METERED @MEAD
13HA105001E3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT,WITH HUALAPAI SOLAR PROJECT EXPORTING 260 MW

13ha-ns1e3.chf

c:\upslf163\mypslf\stab

Tue May 05 08:43:09 2009

Frequencies:



○	58.5000 fbus	24801	DEVERS 500.0	0	0.0	1	1	60.5000
×	58.5000 fbus	24086	LUGO 500.0	0	0.0	1	1	60.5000
□	58.5000 fbus	26094	SYLMARLA 230.0	0	0.0	1	1	60.5000
△	58.5000 fbus	22468	MIGUEL 500.0	0	0.0	1	1	60.5000
◇	58.5000 fbus	22536	N.GILA 500.0	0	0.0	1	1	60.5000

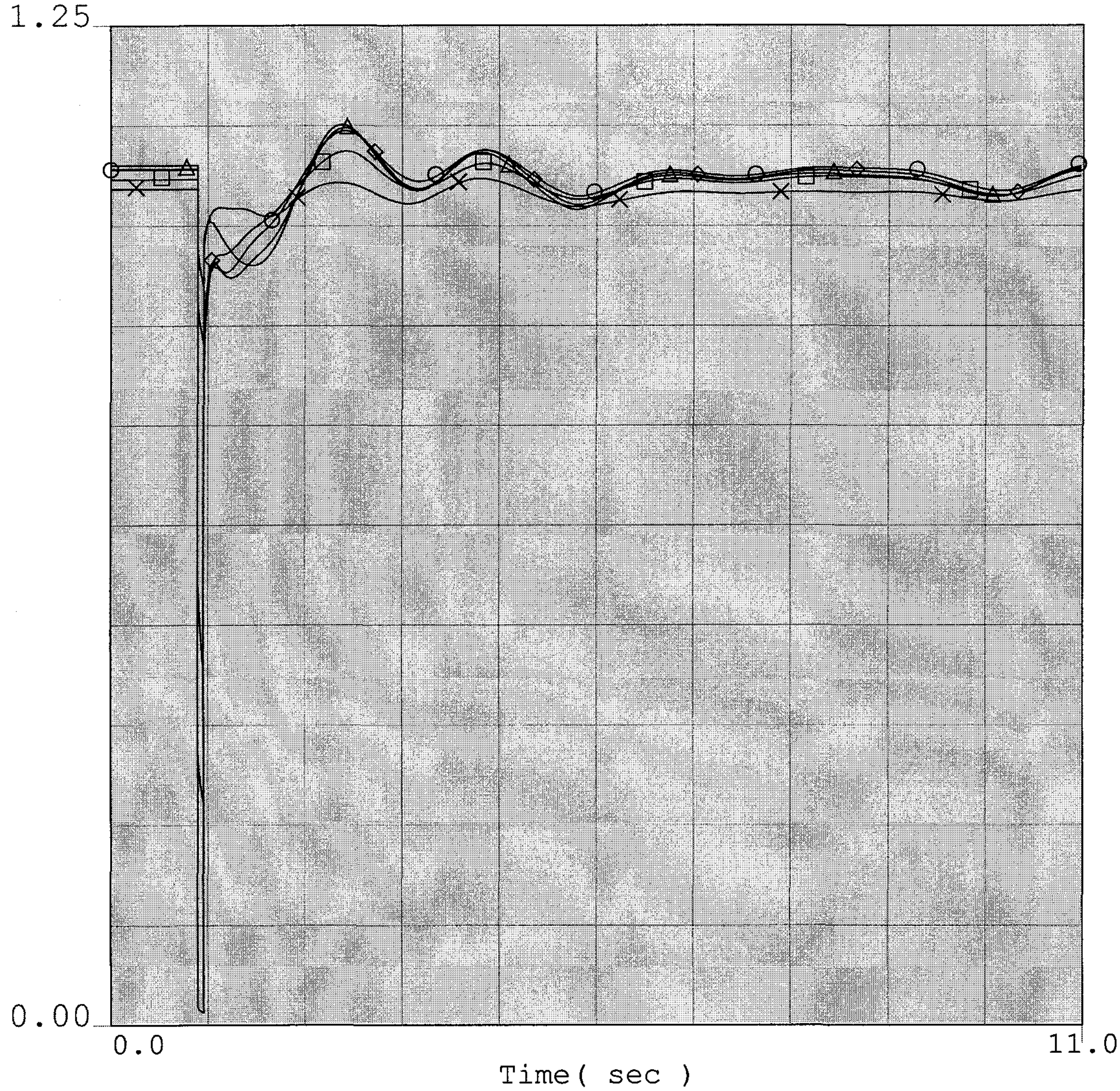
13HA-POST CASE E: POST-PROJECT SCENARIO E BASE CASE WITH 260 MW TO CA
HUALAPAI SOLAR PROJECT TURNED ON AND NO HIGH QUEUE PROJECTS WERE MODELED
EOR=10500MW,PERKINS-MEAD=1893MW METERED @PERKINS &@ 2077MW METERED @MEAD
13HA105001E3:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=10500MW,LGSIS IMPACT,WITH HUALAPAI SOLAR PROJECT EXPORTING 260 MW

13ha-ns1e3.chf

c:\upslf163\mypslf\stab

Tue May 05 08:43:09 2009

ARIZONA_voltages:



○	0.0000 vbus	15021	PALOVRDE 500.0	0	0.0	1	1	1.2500
×	0.0000 vbus	14001	FOURCORN 500.0	0	0.0	1	1	1.2500
□	0.0000 vbus	15011	KYRENE 500.0	0	0.0	1	1	1.2500
△	0.0000 vbus	14003	NAVAJO 500.0	0	0.0	1	1	1.2500
◇	0.0000 vbus	14005	WESTWING 500.0	0	0.0	1	1	1.2500

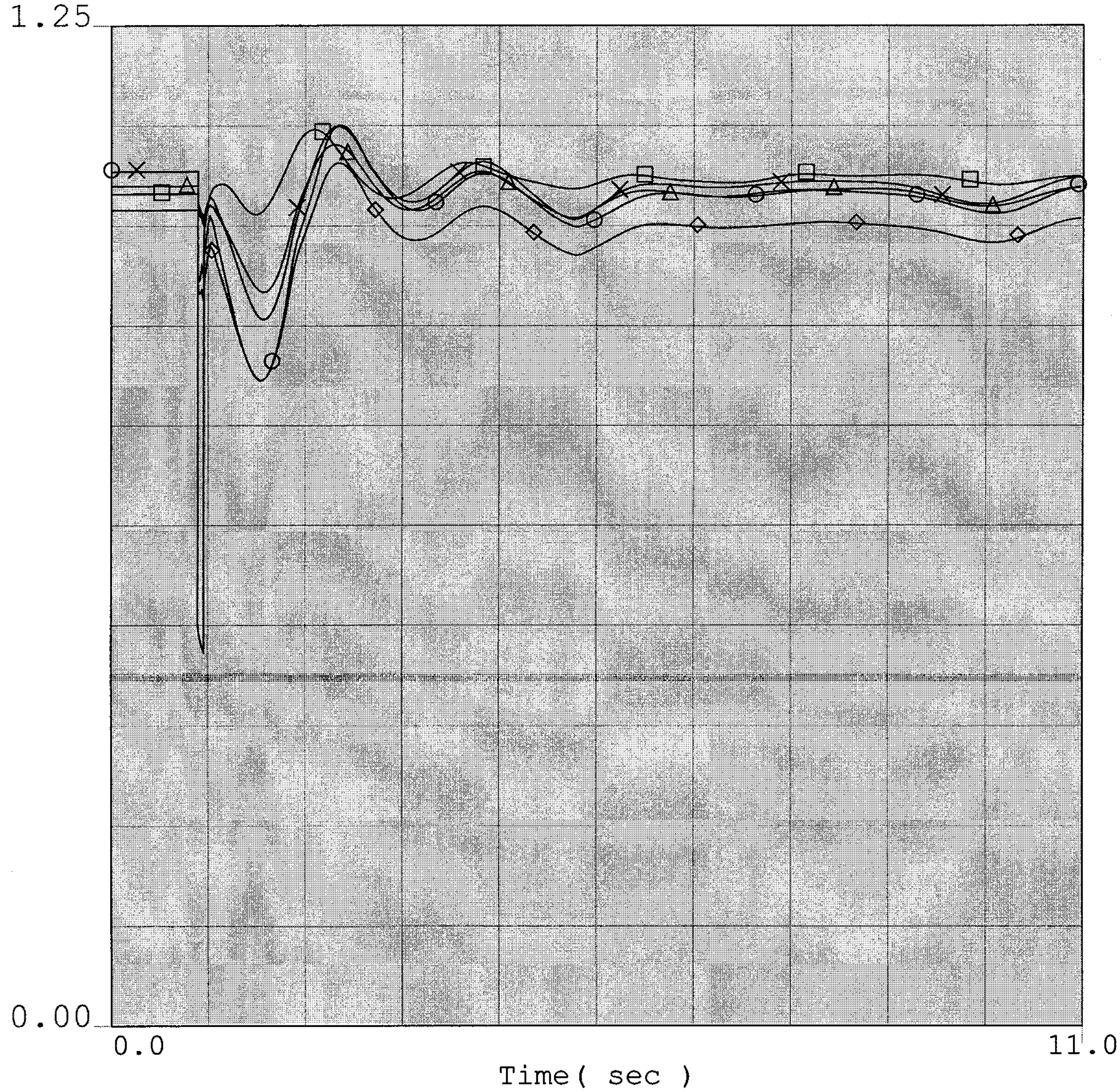
13HA93001B3S:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=9300MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3s.chf

c:\upslf163\mypslf\stab

Thu Jun 04 15:46:28 2009

CALIFORNIA_voltages:



○	0.0000 vbus	24801	DEVERS 500.0	0	0.0	1	1	1.2500
X	0.0000 vbus	24086	LUGO 500.0	0	0.0	1	1	1.2500
□	0.0000 vbus	22536	N.GILA 500.0	0	0.0	1	1	1.2500
△	0.0000 vbus	26094	SYLMARLA 230.0	0	0.0	1	1	1.2500
◇	0.0000 vbus	24804	DEVERS 230.0	0	0.0	1	1	1.2500

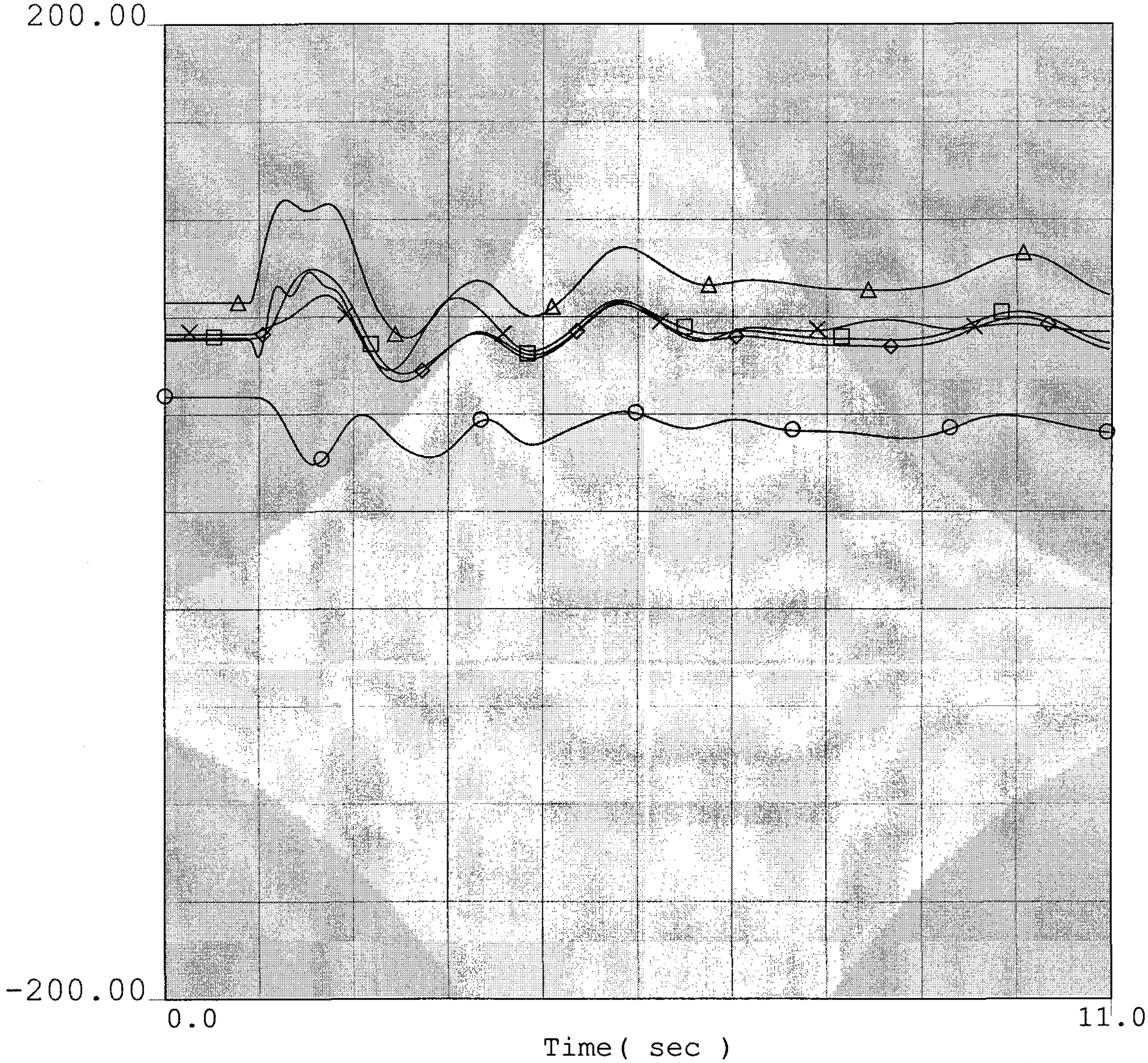
13HA93001B3S:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=9300MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3s.chf

c:\upslf163\mypslf\stab

Thu Jun 04 15:46:29 2009

SYSTEM_Rotorangles



○	-200.0000 ang	24129	S.ONOFR2	22.0	0	0.0	1	1	200.0000
X	-200.0000 ang	26039	INTERM1G	26.0	0	0.0	1	1	200.0000
□	-200.0000 ang	15981	NAVAJO 1	26.0	0	0.0	1	1	200.0000
△	-200.0000 ang	14931	PALOVRD1	24.0	0	0.0	1	1	200.0000
◇	-200.0000 ang	14095	HUAPIVG1	21.0	0	0.0	1	1	200.0000

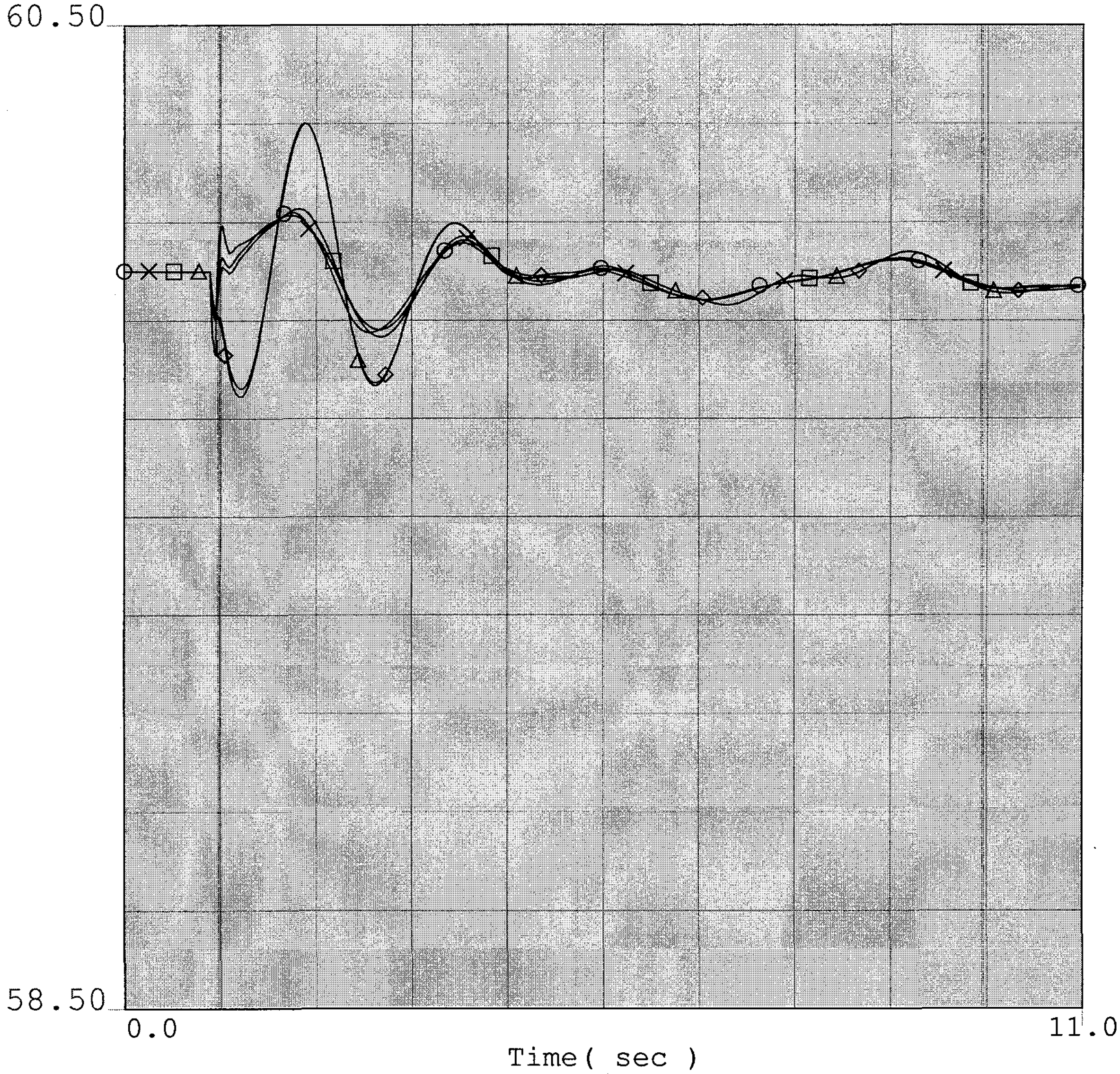
13HA93001B3S:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=9300MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3s.chf

c:\upslf163\mypslf\stab

Thu Jun 04 15:46:30 2009

Frequencies:



58.5000	fbus	24801	DEVERS 500.0	0	0.0	1	1	60.5000
58.5000	fbus	24086	LUGO 500.0	0	0.0	1	1	60.5000
58.5000	fbus	26094	SYLMARLA 230.0	0	0.0	1	1	60.5000
58.5000	fbus	22468	MIGUEL 500.0	0	0.0	1	1	60.5000
58.5000	fbus	22536	N.GILA 500.0	0	0.0	1	1	60.5000

13HA93001B3S:3PH NORMAL FAULT CLEARING ON HAASYAMPA-N.GILA 500kV LINE
WITH EOR=9300MW,LGSIS IMPACT, COMBINED HIGH QUE AND HUALAPAI SOLAR PROJECTS

13ha-ns1b3s.chf

c:\upslf163\mypslf\stab

Thu Jun 04 15:46:31 2009